ENGINEERING AND MINING JOURNAL

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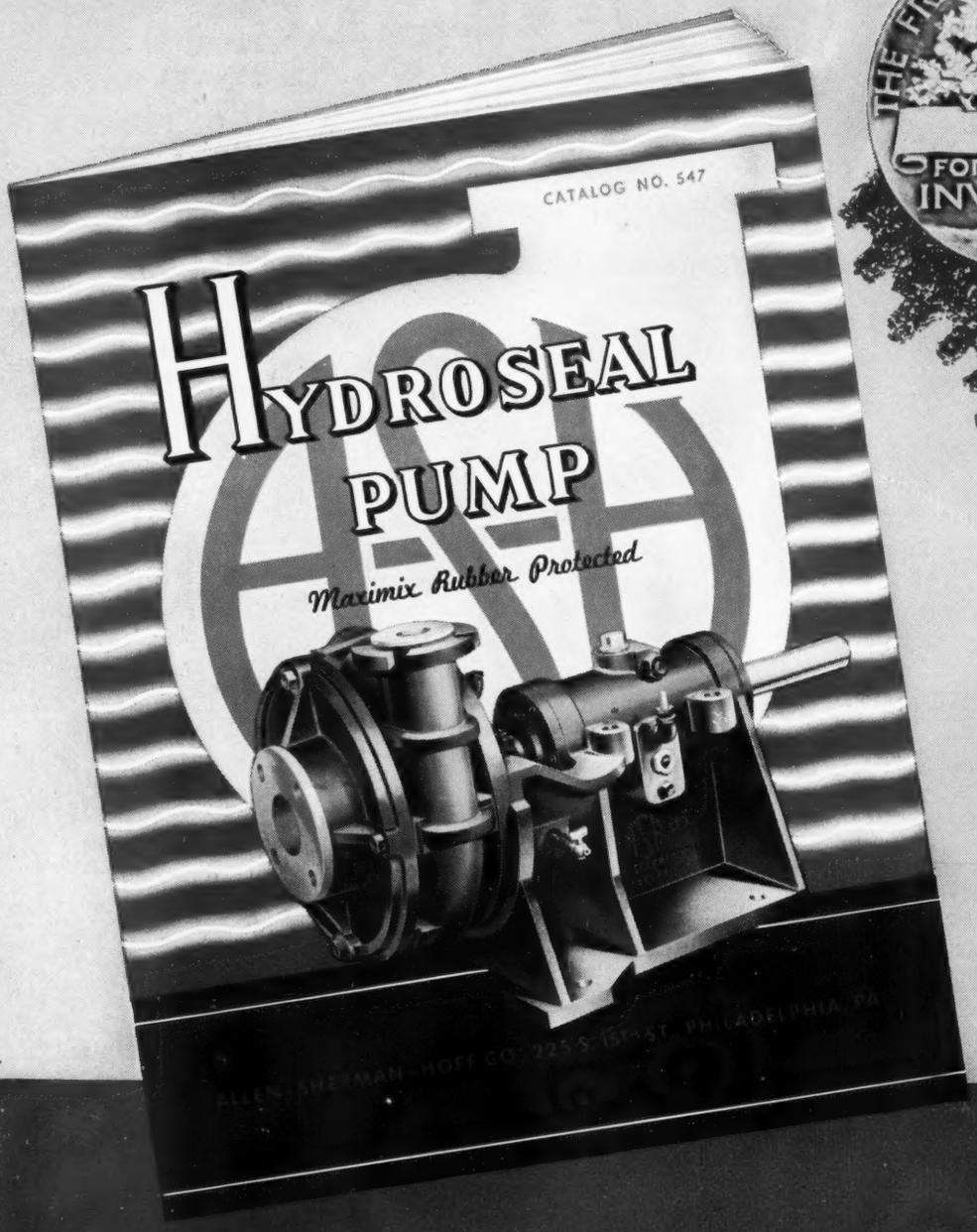
Revised Mineral Reserves Estimates—Page 80

NEW CATALOG
Post-War Hydroseal Pump



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ENGINEERING AND MINING JOURNAL

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Combat the "Have-Not" Propaganda

IF THE domestic metal-mining industry would protect itself against serious danger from public misunderstanding of the ore-reserve situation, it must take active steps to combat the rapidly growing impression that some of our national mineral resources, like copper, lead, and zinc, are really near exhaustion.

The threat of harm is no empty one. The idea that we are mineral "have-nots" has already been pretty well sold to the public and to Congress. If they believe that we can no longer depend on substantial domestic supplies of these necessary raw materials, they are likely to deny to domestic operations the protection needed to encourage adequate, progressive industries producing and searching for these metals.

Since estimates of our ore-reserve position have been publicized by the Bureau of Mines and Geological Survey, they have had widespread attention in newspapers and popular magazines, including the "American Magazine", the "United States News", and "The American Legion Magazine." They have been used by both Interior secretaries Ickes and Krug as background for increased budgetary demands. President Truman, in his last State-of-the-Union message to Congress, said that we are rapidly becoming a "have-not" nation.

The handicap in dealing with this situation is that, in general, the figures presented cannot be attacked as untrue. We firmly believe that they are, if anything, generous as engineers' estimates of measured (proven), indicated (probable) and inferred (possible) reserves. The difficulty is that most of the authors who use these data—and certainly the public—presume the estimates to represent the nation's total reserves, discovered and undiscovered, economic and submarginal. The explanation of why similar estimates prepared ten years hence may be as large or larger is by comparison technical, dull, and not easily understood.

One of three recent examples of "have-not" publicity is a voluminous study by the Twentieth Century Fund, an endowed institution, undertaking to analyze the United States' economy during the decade 1950-60. Like the other presentations for popular consumption, this study repeated the Bureau-Survey figures without the necessary qualifications that would make the truth apparent to laymen (E.&M.J. May, insert preceding first editorial text, page 57).

On April 30 Editorial Research Reports, Washington, D. C., a purveyor of background material for newspapers, issued "Copper Shortage." This pamphlet contends that an acute and dangerous copper shortage is in prospect for mid-1947, that domestic reserves of copper ore are near exhaustion, and that new bonanzas are unlikely to be discovered. The remainder, except for referring to a mythical shortage of aluminum, is pretty much a repetition of the "smear" publicity recently put out against the copper industry by the Federal Trade Commission (E.&M.J., April, pp. 71 & 106).

In the "Saturday Evening Post" of May 17, Secretary of Commerce Harriman writes "We Must Import to Live." The article states, "Having ruthlessly tapped our natural resources, we are becoming a 'have-not nation'." Other quotes follow:

" . . . Although we have plenty of one of the main alloying ores, molybdenum, we are virtually lacking in the others, cobalt and chromium. Indeed, we are badly short of many of the most significant ferro-alloying and specialized minerals—antimony, manganese, nickel, tungsten, vanadium, and so on . . . ."

" . . . Through a long list, from bauxite and copper to vanadium and zinc, the richness of the American earth is running out. We must begin to turn to the rest of the world for many of the basic raw materials . . . ."

" . . . We are at present gravely short of lead, although for many years we produced, and indeed are still producing, more lead than any other country in the world. There are two causes of this strange phenomenon. First, although our 1945 output of 400,000 tons of refined lead was the

world's highest, it was only about two-thirds of our output in the best years of the past. Our lead reserves have been depleted. Despite special price inducements to make it profitable to operate marginal lead deposits, we found it impossible to equal our former records."

" . . . Modern technology can make it commercially feasible to exploit marginal deposits of raw materials, but it cannot make it as cheap as exploiting the better deposits. . . . Thus, for many reasons—among others, the need to maintain reasonable reserves of raw-material deposits for national defense and the protection of our economic well-being—we must consider putting a brake on this trend toward a 'have-not' position by purchasing more of these raw materials in the world market from other nations . . . ."

As in the other instances, it is what Mr. Harriman leaves unsaid that invites public misunderstanding. He does not explain that the nation's tax policies make exploration for new deposits financially unwarrantable nor that the manpower shortages of wartime forced the mining industry to abandon much exploration and development. He does not mention that SEC regulations for many years hampered the financing of new mining ventures and that the complexity of state "blue-sky" regulations is still a serious handicap; also, that the political game of using business as a whipping boy deterred the long-range investments required to find new mines. He takes no account of the fact that foreign measured and inferred reserves of many minerals are not far different from our own in terms of annual requirements, and that foreign peoples are showing a disposition to charge what the traffic will bear. The implication that we should lend less encouragement to domestic production takes no heed of the fact that our greatest opportunity to obtain future supplies depends more on continued technical progress and investment than on any other factor.

In the face of all this adverse publicity it is insufficient to depend on faith that right will prevail. Serious injury can be done, before Congress and the public discover what is a sound policy toward mineral development. To avoid such injury the mining industry must take positive steps to bring its viewpoint to public attention.

More Advocacy of Gold

AS ADDITIONAL EVIDENCE of the broad movement which is developing to return to gold as the basis of currencies (E.&M.J.,Feb.,p.69 and April,p.72) we quote the following address on "Iron Curtain Issues in World Trade" by John Abbink, chairman of the National Foreign Trade Council and president of McGraw-Hill International Corporation:

"I have growing conviction that it is time for the United States to begin serious consideration of the free coinage and circulation of gold. Every trading nation of the world, with the important exception of Russia, wants its currency to have a high, stable value in international markets as a means of stimulating its foreign trade. The problem today is not, as it may have been in the thirties, one of too little money, but rather that of too much "soft" money. Other currencies are now tied to the dollar as they once were to sterling; get the dollar itself back on gold, and a "hard" money standard will be reestablished.

"Even with rigid trade and exchange curbs, most other countries have maintained some semblance of stability in value for their currencies only with United States assistance. If and when the well of our credit runs dry, the world-wide devaluation race we witnessed a decade ago might easily be repeated.

"Once the dollar were again coined in gold and circulated internationally, new gold, wherever situated, would add dollar for dollar to the world supply of United States exchange available for the purchase of commodities here or elsewhere. Additional gold production would be encouraged, with a corresponding increase in dollar resources, and the path toward world trade recovery and currency stabilization be indicated, and the tasks of international monetary and credit agencies eased.

"I am neither competent nor disposed to elaborate the issue here, excepting to point out that a move so dramatic as the re-establishment of gold would confound and discredit the international apostles of communism overnight. It would divert world thinking from an economic system based on barter—which Russia wants—to a system based on values, which I embrace as our own. Many have expressed surprise and disappointment that Russia has withheld adherence to the International Bank and the Monetary Fund. Why should Russia cooperate in a system she pretends to abhor, so long as we make concession after concession to Soviet economic theories, and permit Moscow's gold meanwhile to trickle into foreign black markets at prices ranging up to $100. per ounce?

"Russia vies with the United States for world political leadership with some success because the science of semantics is not an exact one; words—'democracy,' for instance—can be assigned various

meanings in translation. She struggles with us for economic supremacy because, in a world of 'soft' currencies, there is no norm, and values are easily distorted; and she is quite content to permit us to cuddle the phrase 'moral leadership,' which is an empty one in her lexicon and that of her disciples.

"Whether we like it or not, let's face the fact that as a nation we are in the midst of a world struggle, politically, economically and morally, with communism. We are at a disadvantage politically because the meaning of words can be twisted; we must, therefore, emphasize our economic strength to overcome that handicap."

Only a year ago, the opinion of most economists was that the day of reckoning over "funny money" policies could be delayed by foreign dollar balances, and by the World Bank and Fund for some such period as five years. It now appears that in this fast-moving world the necessity of going through "the wringer" is much nearer. The gold miner seems due to get an economic benefit.

Government Still Eyes the Mineral Fertilizer Industry

THE QUESTION as to how much further the Federal Government will go in injecting itself into the business of producing fertilizers in competition with private industry, including the companies mining phosphate and potash, is still unanswered. Some aspects of the situation as it existed two years ago (E.&M.J., July 1945, p.67) have improved, but others still give concern. The sections of the then new potash regulations which tended on the one hand to discourage private exploration for potash and on the other required a company upon one year's notice to sell to the Government at the latter's own price up to a quarter of its annual output have been amended. An exploration permit may now be secured for as much as 40 sq.mi. of the public lands, as compared with the acreage equivalent to 24 sq. mi. prescribed in the regulations as originally issued. To some, the increase would appear to be negligible, all things considered. The portion of a company's output that may be requisitioned upon a year's notice has now been cut to 10%, this as before in addition to any payment of royalties in kind. Such a requirement, even though it represents a liberalization of the regulations, has no justification in existing law. In the long run, to cramp private exploration for potash on the public lands while the Government remains free to explore to the extent that it can get the money, at the same time forcing a producer to give up part of his output beyond any payment of royalty in kind, imposes an unwarranted curb upon private initiative and enterprise.

Despite the defeat in the last Congress of Senat Bill 882 and its companion measure H.R.2922, which sought as their stated object to establish by law a "national fertilizer policy and program" (E.&M.J., op.cit.), new endeavors are now being made in the same direction and by the same group. Already a bill, S.1251, "to provide for the establishment of a national soil fertility policy and program," is being pushed in the Senate, and an identical bill, H.R.3421, has been introduced for consideration by the House of Representatives.

Though the new measures are alleged to be drawn in the interest of agricultural development —a laudable objective if true—they retain the provision of the defeated bill that Congress should keep the rest of the phosphate and potash in the public domain as a "public trust." They also authorize the immediate construction of an additional TVA fertilizer plant at Mobile, Ala., and the financing of other plants in the West with Government money. The TVA is likewise authorized to acquire phosphate lands in Florida as a source of supply. Farmer cooperatives are also to be encouraged to enter the fertilizer business with Government loans to finance the construction of fertilizer plants and to acquire mineral reserves therefor.

The bill likewise stipulates that future leases issued for the extraction of phosphate or potash under the mineral leasing laws shall "contain such terms and conditions including provision for the sale of a percentage of the production for use in carrying out the national fertilizer program established by the act as the Secretary of the Interior determines will be in keeping with the purpose of Title I hereof." Thus a legal basis would be provided for what the Department has sought to do under its Potash Regulations without the authority of law. Beyond this, a great deal is apparently to be left to the Secretary's discretion.

Caution dictates a careful study of the bill and a watchfulness on the part of the mining interests affected to avert any unpleasant surprise. Though the welfare of the agricultural industry and the fertility of the nation's lands are of paramount importance, the former should be achieved without injury to the efficient mining industry that produces the fertilizer raw materials. Of the latter we have a vast abundance, both of phosphate and of potash, which can be made available to the farmer without any officious paternalism on the part of the Government.

Diesel Power Can Be Used Underground With Safety

D. HARRINGTON [1] and J. H. EAST, JR.[2]

CONSIDERABLE INTEREST has been shown in the prospective use of diesel-powered haulage equipment in underground mines. Foreign technical magazines have devoted considerable space to the use of diesel locomotives in European mines and a limited amount of mention has been made in the technical magazines in the United States. The Bureau of Mines has conducted extensive tests of the gases produced in the exhaust of diesel engines under varying conditions and in differing atmospheres. This article is intended to provide information showing how diesel-powered equipment is used successfully in some underground mine workings in the United States and in Europe; to give a brief discussion of the characteristics of the toxic gases found in the exhaust of diesel engines; and to point out that diesel-powered equipment can be used with reasonable safety in underground mines if the necessary, and entirely feasible, precautions are taken.

Diesel Exhaust Gases

The exhaust of the diesel engine consists of the products of combustion of the fuel oil and the air in which it is burned. The fuel oil consists of approximately 85% carbon, with the remainder hydrogen and possibly small quantities of sulphur. When the diesel engine is operated within its normal range of power output, practically all of the carbon in the fuel oil burns to carbon dioxide and the hydrogen burns to water; any sulphur present burns to oxides of sulphur. A small part of the carbon in the fuel oil does not burn to carbon dioxide, with the result that a relatively small amount of carbon monoxide is always present in the exhaust gases which are generated by diesel engines.

Aldehydes are produced by partial combustion of fuel oil in a diesel engine cylinder; these largely are responsible for the odor associated with the exhaust.

Oxides of nitrogen are formed by the reaction of the oxygen and the nitrogen of the air inside the cylinders during combustion. The chemical reaction takes place because of the high temperature in the cylinders during combustion; the fuel oil is not believed to enter into the reaction.

The composition of diesel exhaust gases depends on the air and fuel in the cylinders during combustion, or in other words, the air:fuel ratio. The ratio is expressed in terms of pounds of air per pound of fuel. The maximum ratio is at full speed and load, as when the engine is working at its highest capacity; this is significant, because the weight of the exhaust gases is at a maximum when the engine is working at capacity and requires full throttle or injection of fuel oil.

The air:fuel ratio varies with the elevation above sea level where the unit is operating. A diesel engine that is adjusted so that it is in perfect working condition at 1,000-ft. altitude and the exhaust gases well within permissible limits will not be adjusted properly to work at 8,000-ft. altitude, because the air is lighter. Therefore an adjustment must be made in the amount of fuel injected into the cylinders to restore the air:fuel ratio. The air:fuel ratio of 20 lb. of air per pound of fuel is selected generally as the one most desirable for best operation at full load and full speed.

Characteristics of Gases

Principal gases composing the diesel exhaust are: Carbon dioxide, carbon monoxide, oxides of nitrogen, aldehydes, oxides of sulphur, oxygen, nitrogen and smoke.

Carbon dioxide is a colorless, odorless gas; it is heavier than air and may accumulate near the floor of a tunnel or mine working that is inadequately ventilated. The maximum carbon dioxide in which a diesel engine can be operated safely is 1%, but 0.5% is the preferable high limit.

Carbon monoxide is a colorless, odorless gas; it is slightly lighter in weight than air and diffuses easily into the surrounding atmosphere, but it may accumulate in the top of working places that are not well ventilated. It is extremely dangerous to breathe; a carbon monoxide content of 0.20 to 0.25% in air that is breathed produces unconsciousness in approximately 30 min.; a concentration of 0.04% causes headache and discomfort within 2 to 3 hours.

Oxides of nitrogen. The term "oxides of nitrogen" is applied to the toxic oxides of nitrogen (NO) and nitrogen peroxide (NO_2), or mixtures of them. The most serious consequence of inhaling these gases is the formation of nitric and nitrous acids in the respiratory system. The presence of only a small percentage of oxides of nitrogen in the atmosphere may ultimately cause death.

An atmosphere containing 0.5 to 1.0% of carbon monoxide is likely to be fatal to human beings in less than 30 min. of exposure, while as little as 0.07% of oxides of nitrogen may cause fatalities in the same length of time. This is an indication of the danger from exhaust gas when precautions are not taken while diesel engines are operated in confined places.

Aldehydes. Chemically, an aldehyde is defined as a colorless, mobile, and very volatile liquid obtained from alcohol by moderate oxidation. Aldehydes have a characteristic sharp suffocating odor and even in exceedingly small quantities irritate the eyes and respiratory passages. Their presence in

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DIESEL POWER IS USED UNDERGROUND for locomotives, air compressors, drill jumbos, bulldozers, and as shown in this underground limestone mine, for loaders and trucks. In all instances, the workings are supplied with adequate ventilation.

the exhaust gas is largely responsible for the so-called acrid exhaust from diesel engines; it is likely to be the only odor that can be detected in exhaust gas, because the other gases are odorless, except that slight traces of oxides of sulphur may be present. The odor of aldehydes resembles that of formaldehyde, which is the aldehyde of formic acid.

Maximum Limits of Gases

Various private and governmental groups have determined the maximum limit of certain toxic gases considered permissible in working places. The different groups do not agree in all instances; however, the standards established by all of the groups are feasible to meet in so far as the operation of diesel engines underground is concerned. These limits are shown in Table I, page 73.

The successful use of a diesel engine underground or in confined places where men must work depends largely upon positive and efficient devices that control or remove some of the toxic gases in the exhaust. However, a very important adjunct is the maintenance of an adequate flow of pure air in the vicinity of the engine. If explosive gas or other flammable material is present in the atmoshpere, flame arresters must be provided on both the intake and exhaust of the engine. Also, ultra-high temperatures that may ignite accumulations of methane must be reduced below the ignition temperature of the gas.

Present-day devices for treating exhaust gas are designed to lower the temperature of the exhaust gas, to absorb some of the toxic gases, to remove in a large part smoke and odorous and irritating constituents, and to dilute remaining constituents by admixing them with comparatively large quantities of air before the final exhaust is discharged. The design of some diesel locomotives manufactured in England provides for mixing the exhaust gas of the engine with 30 to 40 times its volume of fresh air before the final exhaust is discharged into the atmosphere.

The simplest type of device for treating exhaust gas consists of a bath of water placed between the engine exhaust ports and the pipe that discharges the exhaust gas into the surrounding atmosphere. Water seems to be the best available absorbent of the toxic and odorous constituents of the exhaust gas. Carbon monoxide is *not* absorbed by the scrubber. There are many variations in the design of the scrubbers; some of the designs provide for shutting off the fuel supply automatically and applying the brakes if the water supply becomes low or the temperature of the exhaust gas exceeds 160 deg. F.

Flame arresters commonly used on the exhaust and air inlet of a diesel engine are of the labyrinth type and consist of a multiple metal-plate device that provides narrow passages for the escaping exhaust gas. Others have porcelain rings which replace the metal plates and offer less resistance to the exhaust gas. Flame arresters must be kept clean or changed frequently, because they tend to clog with soot and build up back pressure.

Diesels in Abnormal Air

The quality of air ventilating places where a diesel engine operates is of utmost importance; the atmosphere in underground mines frequently contains higher than normal amounts of carbon dioxide and less than normal amounts of oxygen. Also it is not unusual in driving tunnels in some rock formations to encounter methane; this must be recognized when calculating the ventilating requirements before a diesel engine is placed in service underground.

Whenever a diesel engine operates in an underground atmosphere containing less than 20.93% oxygen (normal air), the air:fuel ratio at a given speed and fuel input will be greater than that corresponding to operation in normal air.

An atmosphere containing approximately 1% of carbon dioxide may not be dangerous under ordinary conditions, but a diesel engine cannot be operated safely when the atmosphere contains more than 1% carbon dioxide; in fact, diesel engines should be operated in atmospheres that are practically normal air.

Diesel mine locomotives have been used with success in continental Europe for at least 18 years;

most of these are used for main-line haulage units. Diesel locomotives were first permitted in underground gassy coal mines in Great Britain in 1939, but more than 40 units were in operation in 1946. Horsepower ranges from less than 20 for gathering locomotives to 200 for main-line haulage.

In 1939, in Belgium, 62% of all mine locomotives were diesel-powered, and France used 380 diesel mine locomotives in underground mines in 1937. Late statistics show a total of approximately 1,300 diesel locomotives in use in European mines.

Exhaust-gas conditioners are required in practically every country in Europe, but the emphasis is placed on excess ventilation of the haulageways.

Desirable Features

Some of the desirable features for diesel locomotives intended for use in underground metal and nonmetallic mines in the United States are:

(1) Metal and non-metallic mines usually do not require flameproof diesel mine locomotives, but they are desirable in many instances because of possible fires and, under some conditions, explosions of gas or of explosives.

(2) A chemical method of absorbing the aldehydes and oxides of nitrogen in the exhaust gas is desirable. Water absorbs the aldehydes, but the water in the conditioner must be changed frequently enough to prevent it from becoming saturated and thus losing its absorbent qualities.

(3) A chemical method of converting carbon monoxide in the exhaust gas to carbon dioxide, or absorbing the carbon monoxide, is desirable.

(4) The exhaust-gas conditioner should function efficiently for at least one shift without requiring attention, such as changing the water or adding chemicals.

(5) After leaving the conditioner, the exhaust gas should be diluted with air before discharging into the atmosphere; this reduces the hazard from toxic gases to persons in the immediate vicinity of the mine locomotive.

(6) Diesel mine locomotives should be equipped with at least two, and possibly three, independently operated brakes. Air brakes are desirable as well as those that are hand-operated.

(7) The spring suspension of the locomotive should provide maximum stability on rough, uneven track.

(8) Diesel locomotives used in tunnels where combustible gas is likely to occur should be of the flameproof type.

Diesels in U. S. Mines

Diesel locomotives are used in the United States to only a very limited extent. In February 1947, in so far as information was available, only four diesel mine locomotives were operating underground in the United States; two of these were in metal mines, one was in an underground limestone mine, and one in a clay mine.

In 1940, diesel locomotives were used underground during the driving and lining of the Delaware River Aqueduct in New York and much information was obtained by the Bureau of Mines and the Division of Industrial Hygiene, New York Department of Labor, in connection with this enterprise.[3]

Methane Encountered

Five diesel locomotives weighing 14 tons each were used on this project; the engines developed 160 hp. at 1,600 to 1,750 r.p.m. Methane was encountered in some of the tunnels, so the engines were required to be of the flameproof type equipped with labyrinth-type flame arresters on the air inlet and the exhaust. The exhaust gas conditioners, or scrubbers, washed and cooled the exhaust gas while passing through a water spray. The exhaust gas was diluted with air from the fan behind the radiator before it was discharged into the atmosphere. It was found desirable to have approximately 10,000 cu.ft. of air per minute for each diesel locomotive in order to avoid objectionable gas concentrations.

The maximum haulage distance was 5 miles with an adverse grade for the cars loaded with concrete. Each train hauled 20 cu. yd. of concrete, a total of 40 tons. The total distance covered in one month was 11,017 miles and the cost for the month was $0.0222 per ton-mile, covering all expenses.

A diesel locomotive has been in service as a main-line haulage unit at a Western lead-zinc mine for more than one year, and the service is reported to be satisfactory. The elevation of the portal of the tunnel is 10,600 ft. above sea level. The locomotive as originally installed weighed 5 tons but has since been increased to 6 tons to give it more traction. The engine develops 65 b.hp. at sea level, but because of the altitude develops 55 b.hp. at the elevation of the tunnel portal.

Some pertinent data relative to this locomotive are tabulated below:

Diesel-Engine Specifications

Height, over-all	4'6"
Length, over-all	12'0"

LOADING GYPSUM into mine cars with diesel-powered loading equipment. This type of unit is used frequently for clean-up purposes because of its mobility.

[3] Harris, William B.; Greenburg, Leonard, and Werner, Gustav: "Diesel Engines in Tunneling Operations," Transactions of American Institute of Mining and Metallurgical Engineers, Vol. 153, 1943.

Stiefel, Fred W.: "Operation of Diesel Locomotives Underground," Transactions of American Institute of Mining and Metallurgical Engineers, Vol. 153, 1943.

Ash, S. H., and Naus, L. L.: "Use of Diesel Engineers in Tunnels," Bureau of Mines I. C. 7222, 1942, 26 pages.

Holtz, J. C.; Berger, L. B.; Elliott, M. A. and Schrenk, H. H.: "Diesel Engines Underground," Bureau of Mines R. I. 3508, 1940, 48 pages.

Table I. Maximum Permissible Limits of Toxic Gases

Group	Carbon dioxide	Carbon monoxide	Oxides of nitrogen	Aldehydes
	Percent by volume		Parts per million	
Bureau of Mines	1.0	0.01	25	10
U. S. Public Health Service	0.5	0.01	25	10
American Standards Association	...	0.01	25	10
New York	0.5	0.01	40	5
Oregon	0.5	0.01	25	10
Utah	0.555	0.01	10 to 40	20
Massachusetts	...	0.01	10	10

Table II. Analysis of Air in Lead-Zinc Mine

Date sample taken	7-12-46 Percent	7-12-46 Percent	9-5-46 Percent
Oxygen	20.25	20.12	19.98
Nitrogen	79.34	79.41	79.56
Carbon dioxide	0.41	0.47	0.46
Carbon monoxide	0.00	0.00	Less than 0.005
Total	100.00	100.00	100.00
Oxides of nitrogen, parts per million	17	13	28

Table III. Analysis of Exhaust Gases in Clay Mine

	Engine idling	Locomotive hauling loaded trip upgrade	Locomotive hauling 21 cars Empty	Locomotive hauling 21 cars Loaded
Oxygen	20.04	15.48	13.69	13.04
Nitrogen	79.27	80.52	81.03	80.96
Carbon dioxide	0.64	3.87	5.24	5.88
Carbon monoxide	0.05	0.11	0.04	0.09
Methane	0.00	0.02	0.00	0.03
Total	100.00%	100.00%	100.00%	100.00%
Oxides of nitrogen, parts per million	21	173	207	295

Table IV. Analysis of Air in Limestone Mine

Sample location	Face of Room A	Face of Room B	Main return at shaft bottom*
Oxygen	20.92	20.72	20.92
Nitrogen	79.02	79.08	79.02
Carbon dioxide	0.06	0.16	0.05
Carbon monoxide	0.00	0.00	0.00
Methane	0.00	0.04	0.03
Total	100.00%	100.00%	100.00%

* Three diesel trucks had passed in the haulageway in the preceding three minutes.

Analysis of Exhaust Gas From Large Diesel Trucks

	Truck idling		Truck working	
	Truck 2	Truck 5	Truck 2	Truck 5
Oxygen	19.67	19.85	16.87	11.55
Nitrogen	79.41	79.29	80.17	81.67
Carbon dioxide	0.89	0.80	2.93	6.68
Carbon monoxide	0.03	0.04	0.03	0.07
Methane	0.00	0.02	0.00	0.03
Total	100.00%	100.00%	100.00%	100.00%
Oxides of nitrogen, Parts per million	64	13	175	46
Aldehydes, parts per million	30	40		

Table V. Analysis of Air in Shale Mine

	About 150 feet from 350-c.f.m. portable air compressor	Near 500-c.f.m. portable air compressor	At face of room. Electric shovel operating
Oxygen	20.76	20.81	20.87
Nitrogen	79.08	79.07	79.03
Carbon dioxide	0.01	0.11	0.09
Carbon monoxide	0.00	Less than 0.01	Less than 0.01
Total	100.00%	100.00%	100.00%
Oxides of nitrogen, parts per million	12	.....	.....

Width, over-all ..... 3'3"
Track gage ..... 2'0"
Brakes .... Westinghouse air brakes
Speed .... 5 speeds in either direction
Fuel consumption, 3 hours .... 6 gal.

The mine cars are 60-cu.ft. Granby-type and have a capacity of 3 tons of ore; the empty car weighs 2 tons. The locomotive normally pushes 15 empty cars into the mine and returns with 15 loaded cars. The locomotive has brought out 120 loaded cars in an 8-hr. shift under actual working conditions. Estimated capacity of the mine locomotive is said to be 500 ton-miles of loaded cars and 200 ton-miles of empty cars, a total of 700 ton-miles in 8 hrs. The tunnel grade ranges from 0.50% to almost 2.0% in favor of the load.

The locomotive is equipped with air brakes and two hand-operated brakes. The air brakes are on the driving disks; one emergency brake is on the four brake shoes that contact each wheel, and the other brake is on the transmission. Because of the heavy loads and steep grades coming out of the tunnel, more than ordinary braking power is desirable; a special brake car, weighing 3 tons, is fitted with air brakes on all four wheels and is coupled to the engine at all times.

Ventilation Important

At present, the tunnel workings are ventilated by a suction fan on the surface and an 18-in. steel pipe; a booster fan is installed 8,500 ft. in from the portal, and it is stated that 5,000 cu.ft. of air per minute is delivered to the headings. When a raise now being driven to connect with old mine workings above is completed, the ventilation is expected to be improved, and it is hoped that the diesel locomotive will be permitted to operate in all parts of the tunnel workings; the State mining department at present restricts the use of the diesel mine locomotive to the first 8,500 ft. from the portal.

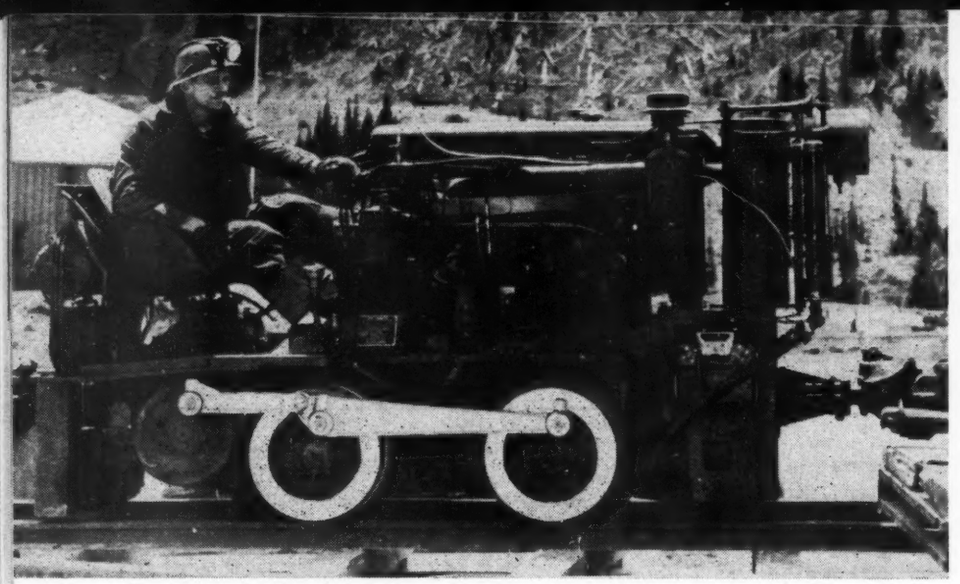
Samples of the general mine air were taken at the end of the diesel run, 8,500 ft. from the portal of the tunnel. See Table II. The air analyses indicate the need of better ventilation of the tunnel; this should be attained by the completion of the raise connecting the tunnel with the lower workings of the mine above. Good circulation of fresh air will then be possible.

A diesel locomotive is used in an underground limestone mine in one of the Western states; this is believed to be the first small diesel mine locomotive used underground in the United States. The locomotive has been in constant use for more than two years. The altitude at the portal of the tunnel is 6,550 ft. above sea level.

Two steeply dipping limestone beds are opened by a crosscut tunnel 8x14 ft. in cross section; drifts are driven right and left at the intersection of each limestone bed. The farthest bed of limestone is intersected by the crosscut tunnel 3,500 ft. from the portal. An average of 6,500 tons of rock a month is hauled from the tunnel.

The locomotive weighs 5 tons. Track gage is 24 in. The exhaust-gas conditioner was disconnected and a slight odor of aldehydes was noticeable.

Underground workings are ventilated by circulating air through



THIS AMERICAN-MADE diesel locomotive has been used successfully at a Western lead-zinc mine. The engine develops 55 b.hp. at the portal elevation, 10,600 ft. above sea level. It hauls 15 three-ton mine cars per trip.

empty stopes to surface openings. Construction of a new ventilating system is in progress and this is designed to circulate 50,000 c.f.m. of air through the stopes. This system will place the diesel haulage road on intake air.

The highest concentration of carbon monoxide observed on a supersensitive carbon monoxide indicator was 0.0025%, and oxides of nitrogen in the general mine air ranged from 0 to 15 parts per million.

Diesel in Clay Mine

An underground clay mine in an Eastern state uses a 10-ton diesel locomotive as a main-line haulage unit, transporting about 135 tons of clay 10,500 ft. underground and 2,300 ft. on the surface. The locomotive has been in service since October, 1941.

The mine is opened by a drift that serves as a haulageway and by two vertical shafts that are used for ventilation. The clay formation is nearly horizontal and a two-entry room-and-pillar method of mining is used. The entries are driven 10 ft. wide and 6 ft. high. The total length of haul underground is 10,500 ft., of which 8,900 ft. is graded in favor of the load and 1,600 ft. is an adverse grade; the 2,300-ft. haul on the surface is an adverse grade. The grades favoring the load average 4.04% for a distance of 8,800 ft. and the adverse grade averages 1.85%.

Air circulation in the mine is induced by a 4-ft., 10-blade disk, exhaust fan. Water-gage pressure is 0.60 in. About 12,000 cu.ft. of air per minute is circulated through the mine. The main haulageway is ventilated by return air, and the air containing the exhaust gases from the diesel locomotive does not pass through the working places.

The locomotive requires an average of 22½ min. to haul a trip of loaded cars from the underground switch yard to the mine scales and 23½ min. to return with empty cars. A trip is composed of 21 cars, which have a total weight of 13 tons when empty. The normal weight of clay handled per trip is 45 tons. The diesel locomotive is not permitted to idle while underground.

The 10-ton, 6-cylinder, diesel locomotive has a compression ratio of 16:1; develops 165 hp. at 2,000 r.p.m., and 125 hp. at 1,200 r.p.m.; has four speeds and a separate reverse gear; and is equipped with vacuum and hand-operated brakes.

Typical analyses of the exhaust from the diesel engine taken under varying conditions are shown in Table III.

The diesel engine is not equipped with an exhaust gas conditioner but has a blower, which according to the manufacturers, is about 1.4 times the piston displacement of the engine. The exhaust gases are diluted to the extent that the blower delivery exceeds the piston displacement.

The production of smoke and of irritating and odorous materials by the diesel engine is not considered objectionable under intermediate or heavy loads; but under light loads, particularly on a downgrade haul, considerable smoke, odor and irritation are evident to the rider on the rear end of the trip. This condition does not exist at the locomotive on either upgrade or downgrade haulage underground, probably because the speed of the engine is faster than the movement of the ventilating air current.

The haulageway at this mine is on return air, hence any odors, smoke or irritants produced by the engine exhaust do not go into the working places — a noteworthy advantage.

Trucks powered with gasoline or diesel engines are used extensively as haulage units in underground limestone and sandstone mines in the Central States. The mines are usually in flat, or nearly flat, formations where roads have moderate grades. The mine workings vary from 12 to 50 ft. in height. The overlying rock is supported by pillars, and usually there are several openings to the surface which provide fairly good ventilation. The cross-sectional area of most of these mine workings is so large that the exhaust gases from the internal-combustion engines are diluted by air current inside the mine and carried away. Mechanical ventilation is seldom used in these mines with adit openings; a few mines are opened with shafts, and these are ventilated much the same as a coal mine.

Diesel Trucks in Shaft Mine

A limestone mine, which is opened by two shafts about 2,200 ft. deep, is using six diesel-powered trucks of 6-cu.yd. capacity each for haulage units and a diesel-powered bulldozer for clean-up purposes. A two-entry room-and-pillar method of mining is used to extract a 17-ft. approximately horizontal bed of limestone. The entries are driven 16 ft. wide and 17 ft. high; the rooms are advanced about 30 ft. wide for a distance of 600 ft. On retreat, an additional 12 ft. of top rock is mined, making the final room size about 30 ft. wide and 29 ft. high.

Ventilation is induced by a reversible fan operating blowing; about 66,000 cu. ft. of air per minute is circulated through the mine in two splits. The haulageways are ventilated by return air when possible.

The trucks are powered by 2-cycle, 4-cylinder diesel engines with 4¼-in. bore and 5-in. stroke. The engines develop 107 hp. at 1,800 r.p.m. The trucks are fitted with a 3-speed transmission and a reverse gear, which gives the trucks three speeds in either direction. The bulldozer develops a drawbar horsepower of

Methods of Determining Ventilating Air Required

METHOD NO. 1

Diesel engines, when in good mechanical condition and operating in normal air, give off noxious gases in the exhaust, and the quantities increase in amount with the brake-horsepower of the engine. At full speed and maximum load, tests show the following amounts of noxious gases are produced per brake horsepower by a diesel engine.

Carbon dioxide ..... 0.267 cu.ft.
Carbon monoxide ..... 0.000592 cu.ft.
Oxides of nitrogen ..... 0.001512 cu.ft.

On this basis it has been determined that approximately 75 cu.ft. of air per minute per brake-horsepower is required for each diesel engine operating underground; this is the minimum requirement and is in addition to the normal ventilation supplied the working place if diesel engines are not employed; also additional volumes of air are required to dilute the aldehydes.

METHOD NO. 2

The volume of the noxious engine gases can be calculated from the analyses of the exhaust gas, and the maximum amount of these gases considered tolerable for a working environment.

The quantity of air that should be supplied to dilute a particular constituent of the exhaust gas can be approximated by substituting in the following empirical formula:

$$Q = \frac{100\ Vmax}{y}$$

in which Q = volume of normal air required for ventilation, c.f.m.

Vmax = maximum volume of the particular constituent under consideration, c.f.m.

y = maximum permissible concentration of the particular constituent under consideration, expressed in percent by volume.

The exhaust of a diesel engine is a mixed gas, and the constituents considered harmful to health are carbon dioxide, carbon monoxide and oxides of nitrogen, hence the total ventilating-air requirements must be sufficient to dilute and carry away all of these. To satisfy this condition the formula becomes:

$$\text{Minimum quantity of ventilating air, (c.f.m.)} = \underset{\text{dioxide}}{\frac{100\ Vmax}{y}} + \underset{\text{monoxide}}{\frac{100\ Vmax}{y}} + \underset{\text{nitrogen}}{\frac{100\ Vmax}{y}}$$

Enough additional air must be supplied to dilute odors of the aldehydes, and maintain sufficient oxygen in the mine atmosphere.

EXAMPLE

A 6-cylinder diesel engine had a piston displacement of 425.3 cu.in. and developed 165 hp. at 2,000 r.p.m. The exhaust-gas analysis, when the engine was operating at maximum load and full speed, was:

	Percent
Oxygen	13.04
Carbon dioxide	5.88
Carbon monoxide	0.09
Methane	0.03
Nitrogen	80.96
Total	100.00
Oxides of nitrogen, parts per million	295

Volume of exhaust gas, cu. ft. per minute $= \frac{425.3 \times 2{,}000}{1728} =$ 493 cu. ft.

METHOD NO. 1

Maximum brake-horsepower 165 b.hp.

75 cu.ft. of ventilating air per minute per brake-horsepower required.

Minimum ventilating air required = 165 × 75 = 12,375 c.f.m.

METHOD NO. 2

Volume of gas produced per minute

Carbon dioxide	493 cu. ft. × 0.0588	= 29 cu. ft.
Carbon monoxide	493 cu. ft. × 0.0009	= 0.44 cu. ft.
Oxides of nitrogen	493 cu. ft. × 0.000295	= 0.145 cu. ft.

The maximum permissible concentration of noxious gas in a working environment as shown in Schedule 22 issued by the Bureau of Mines is:

	Percent	Parts per million
Carbon dioxide	1.0	10,000
Carbon monoxide	0.01	100
Oxides of nitrogen	0.0025	25

Substituting in the formula for minimum quantity of ventilating air:

$$\text{Minimum quantity of ventilating air, cubic feet} = \underset{\text{dioxide}}{\frac{100 \times 29}{1.0}} + \underset{\text{monoxide}}{\frac{100 \times 0.44}{0.01}} + \underset{\text{nitrogen}}{\frac{100 \times 0.145}{.0025}}$$

$$= 2900 + 4400 + 5800$$

= 13,100 cu. ft. of air per minute.

One method gives 12,375 cu.ft. per minute, the other 13,100.

60.1 with a governed speed of 1,500 r.p.m.

A diesel tractor equipped to load material is an auxiliary rock-loading unit; a 1½-ton truck fitted with a 4-cycle, 4-cylinder engine is used as a service truck.

The large trucks are loaded by an electric shovel or by the diesel tractor and transport the limestone to the hoisting shaft; a round trip requires 7 to 10 min., and each truck makes 30 to 40 round trips a shift. The truck engines are stopped while the trucks are being loaded.

The successful use of diesel-powered equipment at this mine is significant. The mine shaft is about 2,200 ft. deep, and ventilation of the working places is induced by mechanical means. The volume of fresh air taken into the mine is sufficient to dilute and carry away the toxic gases of the exhaust from the diesel engines, and the analyses of the samples of the general mine air (See Table IV) indicate that the air in this mine is better than is ordinarily found in mines, notwithstanding the use of seven different diesel-powered units.

Other Uses for Diesels

An underground limestone and shale mine in one of the Central States is using internal-combustion engines as power units for operations other than loading rock.

The mine is opened by two adits and covers an area of approximately 80 acres. The overburden averages about 100 ft. in thickness. Rooms are about 38 ft. wide between staggered pillars approximately 55 ft. square. The rooms average 18 ft. high; all mining in limestone is worked advancing. The shale that overlies the limestone is mined by blasting 18 ft. of shale into the rooms where limestone mining is completed, or abandoned temporarily. The shale mining is worked on the retreat. Approximately 800 tons of rock are produced daily.

Mechanical methods of ventilation are not provided, but the natural ventilation is assisted by two concrete-lined shafts; one shaft is 14 ft. and the other 7 ft. in diam-

eter. Considerable air movement in the mine workings is induced by the piston-effect of the large trucks moving in the relatively narrow passageways. The air measurements taken indicate that approximately 20,000 cu.ft. of air per minute is circulating through the working sections of the mine.

Portable air compressors of 350- to 500-c.f.m. capacity and powered by diesel engines are used. Drill jumbos are mounted on diesel-driven caterpillar tractors. The diesel tractor also pulls the portable air compressor to new working places.

Electric-powered shovels load the broken rock into 15-cu.yd. cars and 10-wheel trucks transport the rock to the crushing plant.

The general mine air along the haulageways and in the vicinity of the working places was sampled, using vacuum tubes and a supersensitive carbon monoxide indicator. The carbon monoxide concentration was not sufficient to be detected by the indicator, which accurately indicates as little as 0.001% carbon monoxide. See Table V.

The use of diesel-powered portable air compressors underground appears to be satisfactory, inasmuch as the analyses show that mine air in the immediate vicinity of the operations is better than normally found in mines. If a portable fan were installed with the unit, it would definitely insure the dispersal of the exhaust gases.

The use of gasoline engines underground is considered hazardous by the Bureau of Mines; the gasoline-engine exhaust contains much more carbon monoxide than the exhaust from a diesel engine in normal working condition. Also the fire and explosion hazard of gasoline is much greater that that of diesel fuel oil.

Two principal methods of determining the amount of ventilating air required to operate a diesel engine safely underground are discussed briefly on page 75. Results obtained independently by these two methods check closely. See example worked out on page 75.

Frequent analyses of the general mine air should be made in the working environments in which a diesel engine is operating. This provides a check against the calculated quantity of air needed to avoid trouble.

State Laws Limit Use

The mining laws and regulations of some states prohibit the use of internal-combustion engines in underground mines; other states have laws and regulations allowing their use providing permission is obtained from the State Department of Mines prior to their installation.

The laws and regulations prohibiting the underground use of internal-combustion engines are intended primarily to prevent the use of gasoline-powered mine locomotives and other equipment. These laws and regulations were placed in effect before the diesel engine was perfected to its present stage of safety and efficiency.

Diesel locomotives for underground use are no longer in an experimental stage in England and Continental Europe. Many locomotives in service in underground coal and non-coal mines (gassy as well as nongassy) of Europe prove that they are successful in this application, and studies by the Bureau of Mines and a limited amount of actual experience in operation of diesel locomotives in underground workings in American mines indicate that suitably designed and operated diesel locomotives can and should be used in the mines of the United States.

Diesel equipment used underground must be kept in good repair at all times; this is a "must" if trouble is to be avoided. The safety devices on diesel locomotives, such as the exhaust-gas conditioner and flame arrester (in coal mines), must be kept in good working order and must be used at all times when the diesel equipment is operated underground; the ventilating-air currents must be sufficiently strong to keep the amount of toxic gases in the general mine air less than the maximum limits regarded as safe for a working environment.

B.L.S. Analyzes Wartime Migration of Miners

TO WHAT EXTENT did non-ferrous metal miners migrate to other industries after the war? The Bureau of Labor Statistics attempted to answer this question by investigating the histories of 431 mine workers from the following communities: Butte, Mont.; Silver City, N. M.; Park City, Utah; Leadville, Colo.; and Stibnite, Idaho. This sample of workers was selected in spring, 1945. Their job histories and earnings were traced back to January, 1941, and rechecked after the war ended (June, 1946.)

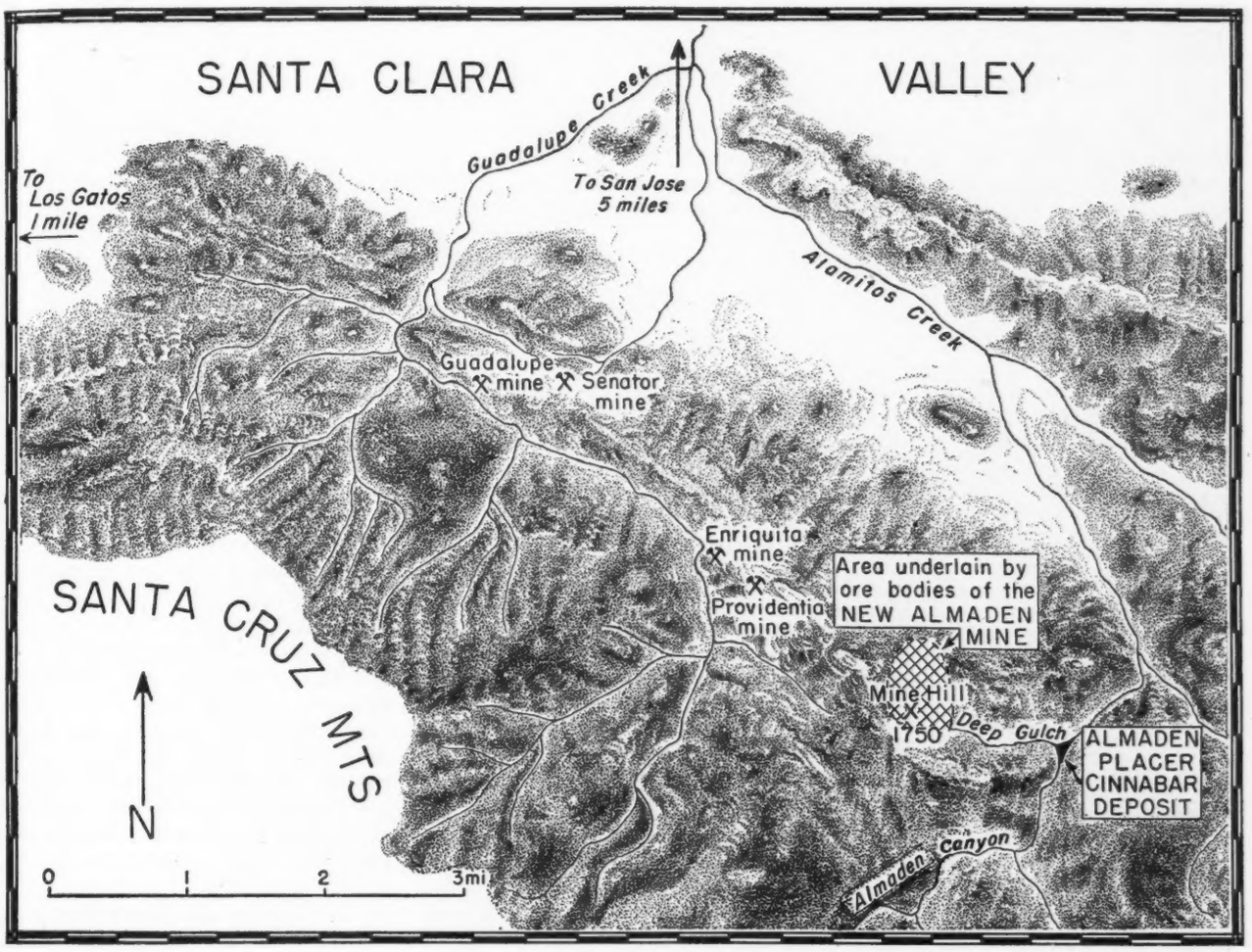
The accompanying table shows what these workers did before and after the war. When the survey started in 1945, more than 40% of the 431 were in the same jobs they held in 1941, and more than half were with the same employer. More than a third changed jobs two or more times, although some transfers were within the same company. In June, 1946, 259 out of 404 who could be located, had not changed employers since early 1945. Eighty-six had new employers, and 22 were self employed. Of the group of 431, 131 were wartime migrants who returned to their prewar residences.

Weekly mining wages rose from an average of $38.27 (for 46.8 hr.) in 1941, to $55.36 (for 49.7 hr.) in spring, 1945. Weekly wages of the metal miners averaged $54.44 in June, 1946. By contrast, earnings of manufacturing workers declined from $46.02 in spring, 1945, to $41.15 in the following winter. The hourly rate for miners averaged 97c. during the war, 23c. above the prewar average.

Distribution of Non-Ferrous Metal Miners by Prewar and Postwar Industry Group

	Number of Workers	
	Jan., 1941	June, 1946
Agriculture, forestry and fisheries	23	8
Mining	310	289
Construction	16	14
Manufacturing	12	8
Wholesale and retail trade	13	14
Finance, insurance, real estate	1	...
Transportation, public utilities	13	11
Building and other services	11	12
Government	13	4
In Armed Forces	4	10
Not in the labor force	7	14
Unemployed	8	13
Not reported	1	7
Total	431	404*

*27 workers could not be located in June resurvey.



SKETCH MAP shows the location of the placer deposit in relation to the lode cinnabar deposits of the New Almaden district.

Almaden Placer Yields Cinnabar-Rich Gravels

E. H. BAILEY and D. L. EVERHART, Geologists, U. S. Geological Survey

THE RECOVERY OF CINNABAR from a placer deposit is justified only under rather unusual conditions, and the same may be said of the application of concentrating processes to quicksilver ores. Attempts to achieve these ends in the past have for the most part resulted in financial losses to the operators. Although placer cinnabar has been mined in a few California quicksilver districts and mechanical methods of cinnabar concentration have been tried at a number of the State's quicksilver mines, the character of the alluvial deposit at Almaden, Calif., together with the methods successfully used in concentrating the ore, presents features which attach particular interest to this operation.

The Almaden placer deposit is situated adjacent to the famous New Almaden quicksilver mine, but is not a part of it. A brief description of the geography and geology of this outstanding mine is, however, necessary in order to clarify the origin, character and relationship of the placer ore occurrence.

The New Almaden district, which has yielded more than 1,100,000 76-lb. flasks of quicksilver, is situated in Santa Clara County, about 9 miles south of San Jose and 50 miles southeast of San Francisco. The New Almaden mine, one of several in the district, has produced about $75,000,000, exceeding all other metal mines in the State in value of yield. Its leadership in this re-

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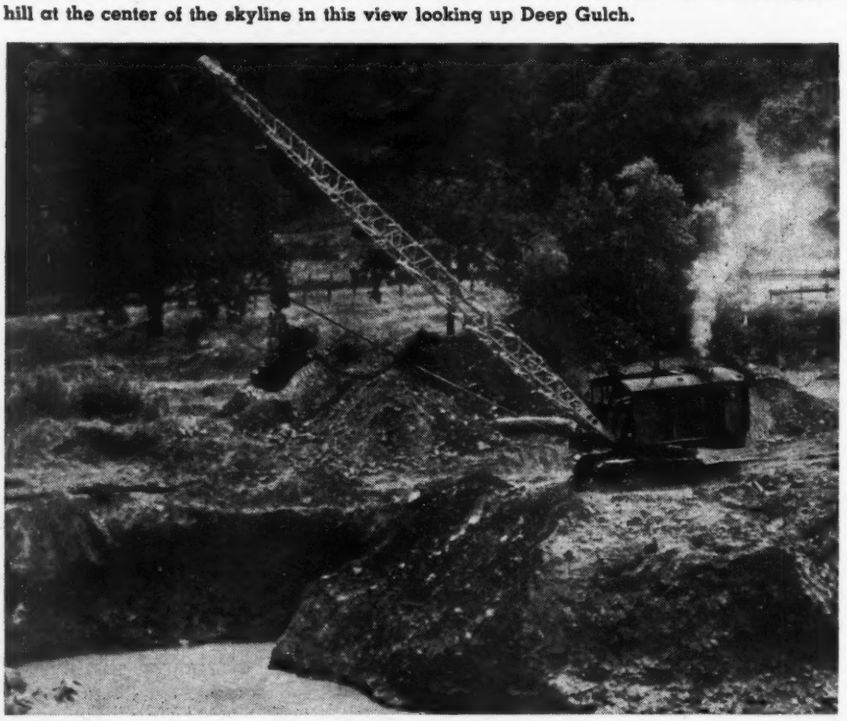
spect seems the more remarkable because most of the quicksilver was sold at less than one-third its recent wartime price of nearly $200 a flask.

The New Almaden mine lies on a low range separated from the northeastern flank of the Santa Cruz Mountains by Guadalupe Creek. The highest point of the range is Mine Hill with an elevation of about 1,750 ft. One mile south of this point the deep Almaden Canyon cuts directly across the range, and a small tributary canyon, known as Deep Gulch, descends abruptly from the top of Mine Hill to Almaden Canyon. The Almaden placer deposit lies in the floor of Almaden Canyon at its junction with Deep Gulch as seen on the accompanying map.

The complex geology of the New Almaden district and the origin and localization of the quicksilver orebodies are not yet fully understood. However, the study of the area by the U. S. Geological Survey, begun as a part of its wartime program of investigation of strategic mineral deposits, and continuing in cooperation with the California State Division of Mines, is sufficiently far advanced to permit a summary statement of the salient features.

ORIGINAL OUTCROPS of the New Almaden ore were near the apex of the flat-topped hill at the center of the skyline in this view looking up Deep Gulch.



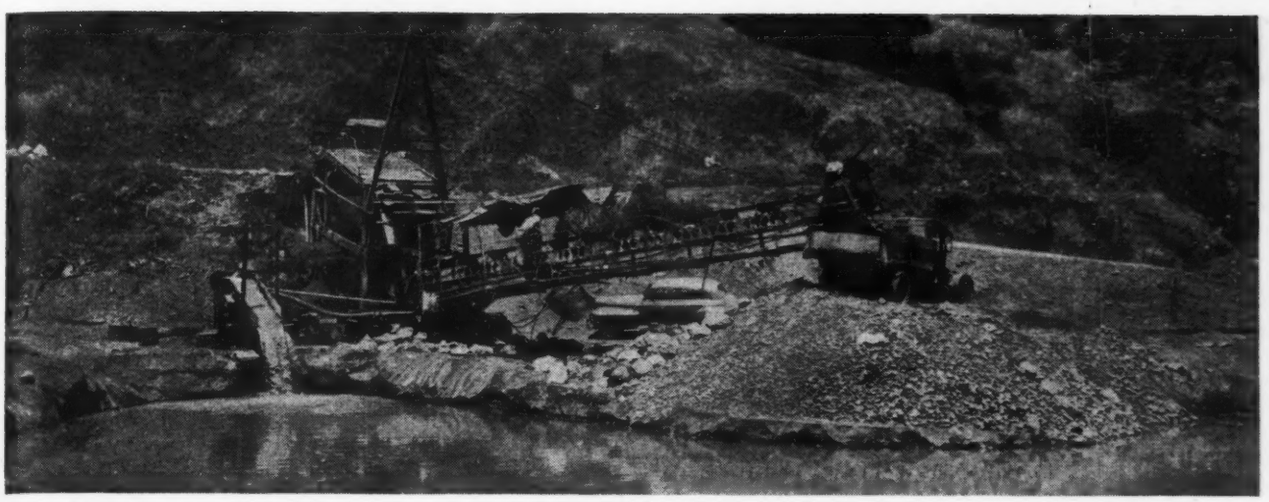
A DRAGLINE is used to mine the gravels to an average depth of 20 ft. Most of the cinnabar nuggets are concentrated a few feet above the sandstone bedrock.

The oldest rocks of the district are feldspathic sandstones, mafic lavas and tuffs termed "greenstones," which with less abundant limestones and cherts comprise the widespread Franciscan group of probable Jurassic age. Intruded into these rocks are tabular masses of ultra-mafic rocks now almost completely altered to serpentine. Some parts of the serpentine masses, notably their margins, are further altered to a rock composed largely of dolomite and chalcedonic silica—the familiar silica-carbonate rock or "quicksilver rock" of the California Coast Range. In a few places this silica-carbonate rock has been replaced by cinnabar, or more locally fractured and filled with veins containing cinnabar, in sufficient amounts to form ore. Beds of a Cretaceous (?) conglomerate cropping out in the headwaters of Almaden Canyon yield easily recognizable boulders by means of which it is possible to differentiate the gravels of the placer deposit.

Origin of Gravels

The orebodies of the New Almaden mine were first discovered near the apex of Mine Hill in 1824, and subsequently underground ore shoots were followed more or less continuously to a depth of about 2,000 ft. The exposures of ore at the surface were apparently small, but as the early-day mining recovered ore yielding more than 30% quicksilver, they must have been exceedingly rich. The outcrops of ore lay at the head of Deep Gulch and doubtless were the source of the cinnabar found as nuggets in the placer gravels now being mined.

The placer deposit is owned and operated by C. L. Thomas and H. F. Austin, who acquired it late in 1945. The property includes the site of the old quicksilver furnaces used to treat the ore from the New Almaden mine, and much of it is covered by large dumps of "burnt" ore. For many years these dumps have been reworked to recover the chunks of ore that were run through the furnaces so fast that the cinnabar was unaffected. Shafts have been put down through the dumps, and workings run from them in the underlying gravels and along



THE GRAVELS are washed and concentrated in a plant consisting of a trommel, sorting belt, and jig which recovers cinnabar pieces down to about ⅛ in. in size. Loss of cinnabar in fines is small. The nuggets average around 75% cinnabar.

the bedrock to recover the liquid quicksilver lost from the old brick, Scott-Huttner furnaces. The gravel that contains cinnabar nuggets was discovered in a test shaft put down near the edge of the old dump at the mouth of Deep Gulch.

The gravels have been mined since the autumn of 1945 from an open pit started near the test shaft, and exposures in the walls of the pit leave no doubt that the cinnabar nuggets being recovered are associated with an old stream-gravel deposit in no way related to the recent dumps. The depth of the gravels in the pit varies, averaging a little over 20 ft., but most of the cinnabar nuggets are concentrated in the lower few feet above the bedrock of Franciscan sandstone. The overlying gravels contain scattered nuggets, and above these is found an iron-stained, nearly barren layer. Parts of the upper walls of the pit are in old dump material which is easily distinguishable from the well-rounded, older gravels.

The lower gravels consist of rocks found in the drainage area of Deep Gulch — sedimentary rocks and greenstones of the Franciscan group, serpentine, silica-carbonate rock, and nuggets similar to the Mine Hill ore. The rounded boulders range in size up to a little more than two feet in maximum dimension; the matrix material is gray to black, sandy mud. The overlying, non-productive gravels contain rocks of the Franciscan group together with boulders of Cretaceous (?) conglomerate which are lacking in Deep Gulch but crop out over large areas in the upper parts of the Almaden Canyon drainage area.

The cinnabar nuggets are of exceptional size and purity. The largest nugget recovered so far weighed just under eleven pounds. Although nuggets 3 in. in maximum dimension are not uncommon, probably the majority range from ½ in. to 1½ in. in diameter. Nearly all the nuggets are at least sub-rounded and most are well rounded; many are flattened. As the gravels apparently contain little cinnabar that would be classed as "fines," it seems likely that the finer cinnabar was carried farther down Almaden Canyon before it settled from the water of the rushing stream.

Nugget Content Is High

The content of cinnabar in these nuggets is amazingly high. Many of them appear to contain over 90% cinnabar. The average grade is best indicated by the average retort recovery of about 140 lb. of quicksilver from 220 lb. of nuggets, equivalent to an average cinnabar content of 75%. The remaining 25% of the material is largely silica-carbonate rock which has not been completely replaced by cinnabar.

The open-pit mining is carried out with a B. & H. No. 700 dragline. The dump material and non-productive upper gravels are piled as waste. The productive lower gravels, with a little of the bedrock, are loaded directly into a 5-ton truck. The ore is moved only a few hundred yards to an efficient washing and concentrating plant which was designed by W. W. Prather and consists of a 4 × 24-ft. trommel, a jig, and a sorting belt. The muddy gravel is slowly fed into the trommel where it is washed by a water spray discharging about 300 g.p.m. The washed material over 1 in. in size is fed onto a 2 × 50-ft. conveyor belt running at a speed of about 100 ft. per min. A few men, usually two, pick from the moving belt the bright red nuggets of cinnabar which are easily distinguished from the other rocks of the washed gravels. The finer material passed by the trommel screen is fed over a double-celled, 42-in. Pan-American jig which recovers the particles of cinnabar down to about ⅛-in. in size; panning of the discharge indicates only a small loss of cinnabar as fines. Power for the entire unit, including the pumps, is furnished by electric motors with a combined capacity of 40 hp.

The nuggets sorted from the belt and intermittently cleaned up from the jig are treated in an oil-fired D-type retort. The usual charge for the pan of the retort is about 220 lb. of nuggets, with which is mixed about 60 lb. of lime to oxidize the large amount of sulphur contained in the rich ore. The quicksilver from the condenser is caught and "bottled" according to usual practice.

While it is not possible to give exact production figures, the recovery from the Almaden placer gravels appears to be giving very satisfactory returns. The unusual conditions which combine to make this possible are: the exceptionally high concentration of cinnabar nuggets in the gravels; the large size and purity of the nuggets; and the design of the concentrating unit, which takes account of the advantageous features of the ore and allows the entire mining and recovery operation to be handled by two or three men.

Interior Department Revises Mineral Reserve Estimates

THE INTERIOR DEPARTMENT has at last made public further details of the mineral reserve estimates prepared by the Bureau of Mines and Geological Survey in a report presented to Congress by Secretary Krug.

The report, a study of the degree of American self-sufficiency in 39 principal metallic and non-metallic minerals, was presented to Senator Malone's subcommittee on mines and mining of the Senate Public Lands Committee in mid-May. The subcommittee is using the report as a "textbook" in a study of the need for an intensive national minerals inventory.

The voluminous report (not yet available to the public) is summarized by Elmer W. Pehrson, chief of the economics and statistics branch of the Bureau of Mines, and S. G. Lasky, principal geologist of the Geological Survey. The summary depicts the extent of American self-sufficiency in the principal minerals. There is no reference to fissionable material in the published report.

Fig. 1 portrays self-sufficiency in terms of two five-year consumption periods, 1935-39 and 1940-44. Before the war, production equaled or exceeded consumption in 11 commodities. For 12 minerals, production ranged from 50% to less than 100% of consumption, six more ranged from 10% to less than 50%, and 10 were less than 10% of requirements.

During the prewar period the country was fully or highly self-sufficient in coal, iron ore, petroleum, copper, sulphur, and phosphate rock. Even then, however, we depended on foreign sources for substantial proportions of our needs of other minerals indispensable to the machine age.

During the war there were notable increases in the ratio of production to consumption in some minerals, and decreases in others. Significant improvement was ob-

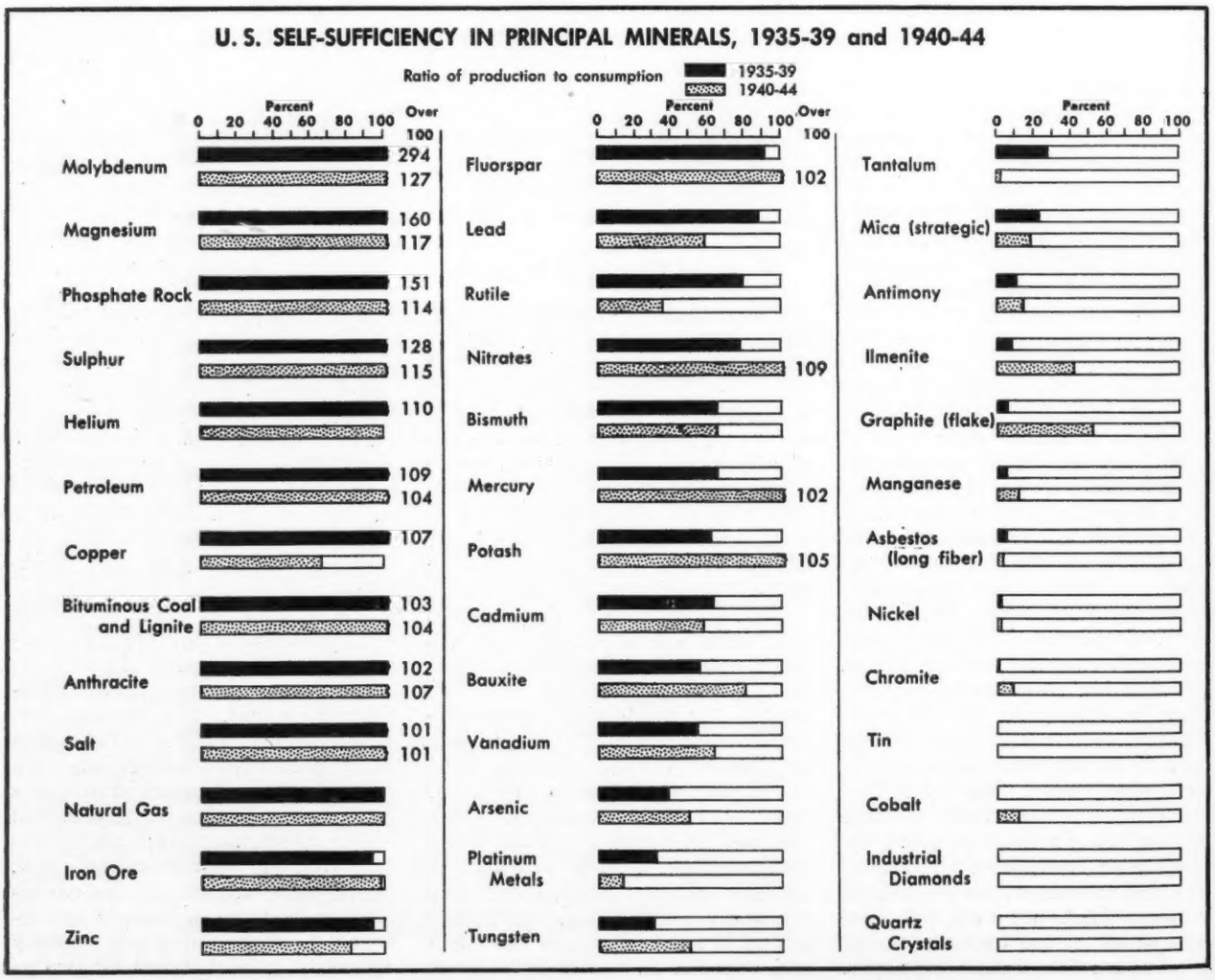


FIG. 1. Production is expressed in percentage of domestic consumption, 1935-39 and 1940-44

tained in iron, fluorspar, nitrates, mercury, potash, bauxite, vanadium, arsenic, tungsten, ilmenite, and flake graphite (which was substandard and unsuited for some important uses). Just as significant was the increase in dependency on foreign sources of copper, zinc, lead, rutile, platinum metals, and tantalum.

The authors of the summary point out that "lack of reserves precluded significant production of many minerals such as chromite, nickel, tin, industrial diamonds, and quartz crystals. For some of the other metals and minerals depletion of the reserves undoubtedly was an important factor but by no means the only one. During the war, the shortages of manpower and equipment and the limitations of installed production capacity were real bottlenecks that prevented full realization of our reserve potential. Opinions differ as to the relative importance of these causes but the fact remains that the war experience demonstrated weaknesses in our mineral position and emphasized the need for doing something about it."

Present Data Inadequate

Just what will be done specifically to catalog our total resources is up to Congress. The Interior Department, in its recent annual report, suggested a 20-year inventory program which would "price tag" all deposits of every valuable mineral. This project, estimated to cost a billion dollars, has been shelved in favor of briefing Congress on the situation and leaving it up to that body to determine how much more we should find out about our resources.

As to the need for further delineation of U. S. reserves, Pehrson and Lasky explain that present knowledge of our mineral resources is wholly inadequate to form a comprehensive and reliable appraisal of our ultimate mineral wealth. For this reason, the data presented in the report are restricted to deposits in known mineralized areas as appraised on the basis of present knowledge. No allowances have been made for future discoveries in new areas. The quantitative estimates presented include measured, indicated and inferred reserves. Inferred reserves comprise material for which there is little if any visual evidence but the occurrence of which can reasonably be inferred from geologic evidence. Many of the estimates include substantial proportions of inferred ore so that, in general, they are considerably more inclusive than those commonly used in commercial practice.

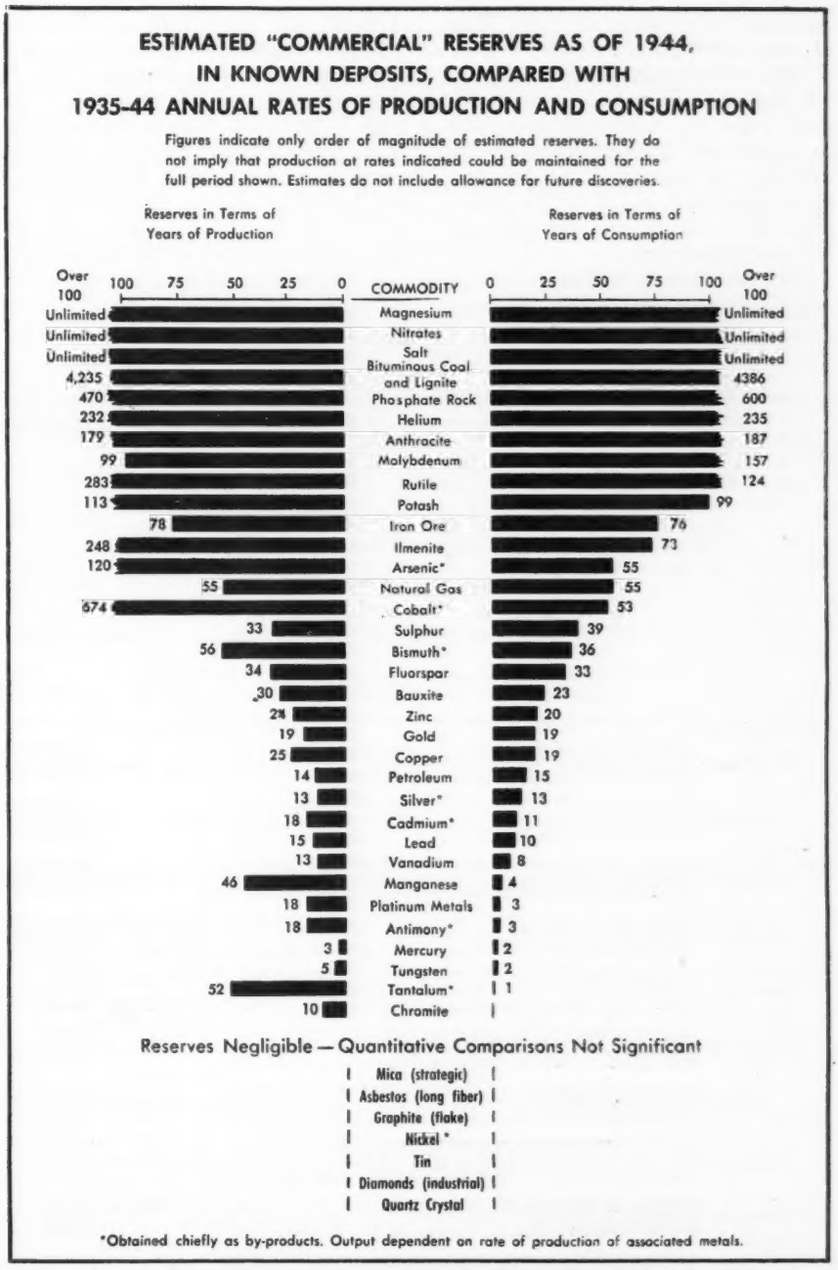

ESTIMATED "COMMERCIAL" RESERVES AS OF 1944, IN KNOWN DEPOSITS, COMPARED WITH 1935-44 ANNUAL RATES OF PRODUCTION AND CONSUMPTION
Figures indicate only order of magnitude of estimated reserves. They do not imply that production at rates indicated could be maintained for the full period shown. Estimates do not include allowance for future discoveries.
Reserves in Terms of Years of Production
Reserves in Terms of Years of Consumption
COMMODITY
Over 100 100 75 50 25 0
0 25 50 75 100 Over 100
Unlimited Magnesium Unlimited
Unlimited Nitrates Unlimited
Unlimited Salt Unlimited
4,235 Bituminous Coal and Lignite 4386
470 Phosphate Rock 600
232 Helium 235
179 Anthracite 187
99 Molybdenum 157
283 Rutile 124
113 Potash 99
78 Iron Ore 76
248 Ilmenite 73
120 Arsenic* 55
55 Natural Gas 55
674 Cobalt* 53
33 Sulphur 39
56 Bismuth* 36
34 Fluorspar 33
30 Bauxite 23
2% Zinc 20
19 Gold 19
25 Copper 19
14 Petroleum 15
13 Silver* 13
18 Cadmium* 11
15 Lead 10
13 Vanadium 8
46 Manganese 4
18 Platinum Metals 3
18 Antimony* 3
3 Mercury 2
5 Tungsten 2
52 Tantalum* 1
10 Chromite
Reserves Negligible — Quantitative Comparisons Not Significant
Mica (strategic)
Asbestos (long fiber)
Graphite (flake)
Nickel *
Tin
Diamonds (industrial)
Quartz Crystal
*Obtained chiefly as by-products. Output dependent on rate of production of associated metals.

FIG. 2. Order of magnitude of estimated "commercial" reserves is indicated, without allowance for future discoveries

In the accompanying illustrations the word "commercial" is defined as meaning any reserve workable under the economic and technologic conditions prevailing in 1944.

Fig. 2 shows the estimated commercial reserves of 41 commodities in known deposits in terms of the average annual production and consumption during the decade 1935-44. Reserves of 15 of the minerals shown in the graph add up to more than half a century's requirements. The reserves of magnesium, derived from sea water and underground brines, and nitrates, obtained from nitrogen in the air, are virtually unlimited. This is also true of salt.

The U. S. has a monopoly on commercial supplies of helium and the reserves are relatively large, in terms of the rate at which it has been used. This country also produces most of the world's molybdenum and the reserve position here is also favorable. Substantial reserves also exist for titanium, but heretofore they have supplied only part of our needs.

Commercial reserves of three minerals—sulphur, bismuth and fluor-

spar—are equivalent to from 33 to 39 years of supply. Known reserves of the remaining 23 commodities will last less than 25 years at the 1944 rate of consumption. This group includes such highly essential minerals as bauxite, zinc, copper, petroleum, lead, most of the ferro-alloying minerals, and several non-metallic minerals.

The reserves of strategic mica, long-fiber asbestos, flake graphite, nickel, tin, diamonds, and quartz crystals, are negligible in amount.

Reserve estimates for natural gas and petroleum contain only "proved" figures. If estimates included indicated and inferred supplies, these two commodities would occupy a considerably more favorable position on the chart.

The size of reserves in terms of past production presents a somewhat different pattern. Since we produced considerably more phosphate rock, molybdenum, and sulphur than we consumed during 1935-44, the size of the reserves in terms of years of production is substantially less than in terms of years of consumption. To a lesser extent the same is true of bituminous coal and lignite, anthracite, helium and petroleum, in all of which we were net exporters from 1935 to 1944. Production and consumption of natural gas were about equal during the period.

Commercial reserves of mangan-

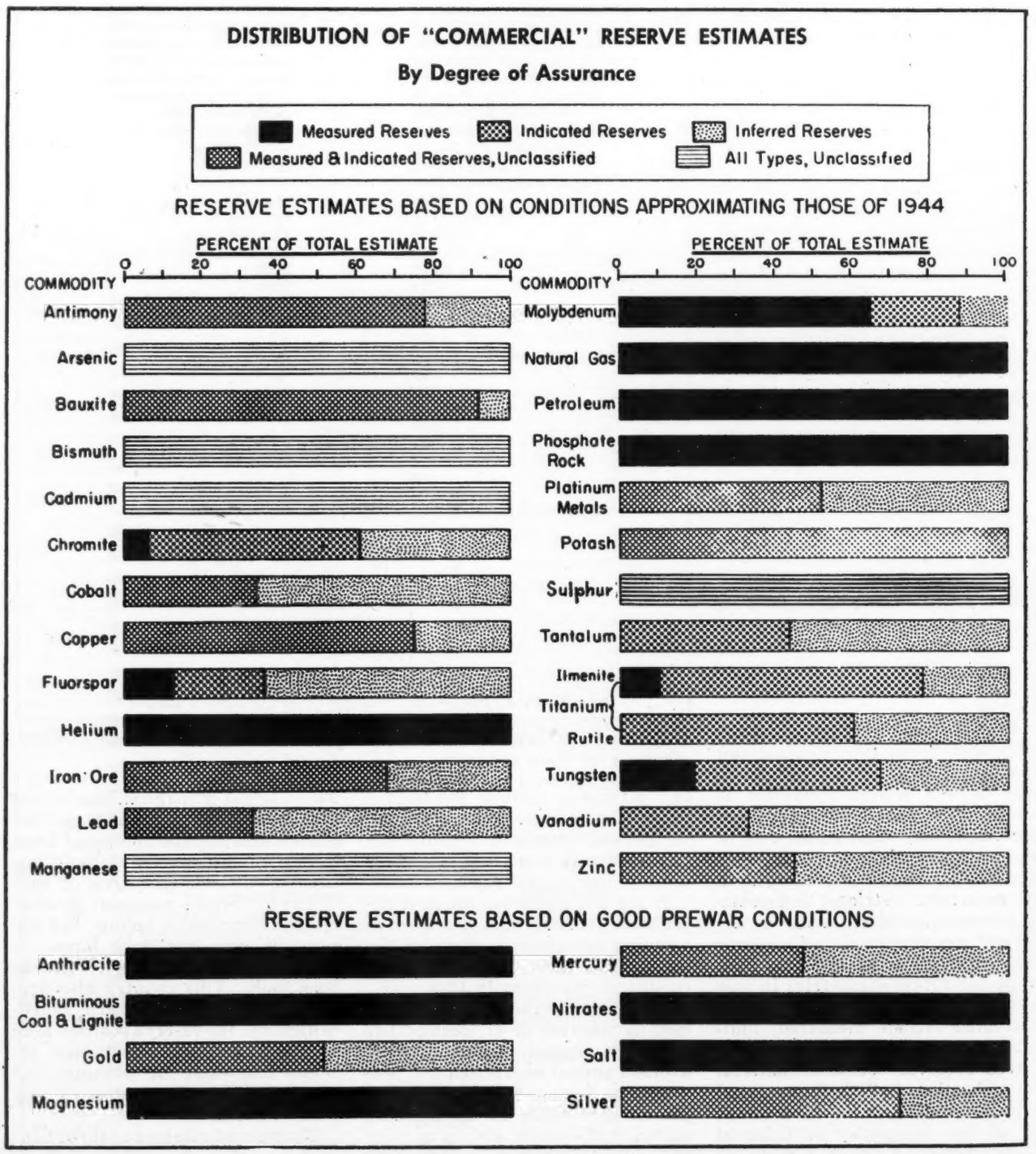


FIG. 3. Percentages of measured, indicated, and inferred reserves included in total estimates of "commercial" reserves in United States

U. S. Mineral Position—Actual, Impending, and Potential

Based on known "commercial" reserves, outlook for noteworthy discovery, and the possibility that known submarginal resources can be made available by technologic progress and improved economic conditions

RELATIVE SELF-SUFFICIENCY

ACTUAL AND IMPENDING

(Based on present technologic and economic conditions and and on known "commercial" reserves)

A. VIRTUAL SELF-SUFFICIENCY ASSURED FOR A LONG TIME:

Bituminous coal and lignite	Molybdenum	Nitrates
Anthracite	Fluorspar (metallurgical)	Phosphate rock
Natural gas	Helium	Potash
Magnesium	Magnesite	Salt
		Sulphur

B. COMPLETE OR VIRTUAL DEPENDENCE ON FOREIGN SOURCES:

1. Small or remote expectation of improving position through discovery:

Chromite	Platinum metals	Quartz crystal
Ferro-grade manganese	Tin	Asbestos (spinning quality)
Nickel*	Industrial diamonds	

2. Good expectation of improving position through discovery:

Cobalt*	Graphite (flake)

C. PARTIAL DEPENDENCE ON FOREIGN SOURCES, ACTUAL OR IMPENDING:

1. Good expectation of improving position through discovery:

Petroleum	Iron ore	Tungsten
Arsenic*	Lead	Zinc
Bismuth*	Mercury	Fluorspar (acid-grade)
Cadmium*	Tantalum*	
Copper		

2. Little hope of improving position through discovery:

Antimony*	High-grade bauxite	Strategic mica
Vanadium		

* *Domestic production chiefly byproduct.*

POTENTIAL

(If technologic and economic changes permit use of known submarginal resources)

A. VIRTUAL SELF-SUFFICIENCY:

Bituminous coal and lignite	Vanadium
Anthracite	Fluorspar (all grades)
Natural gas	Graphite (flake)
Petroleum	Helium
Aluminum ores	Magnesite
Copper	Nitrates
Iron ore	Phosphate rock
Magnesium	Potash
Manganese	Salt
Molybdenum	Sulphur
Titanium	

B. COMPLETE OR VIRTUAL DEPENDENCE ON FOREIGN SOURCES:

Platinum metals	Quartz crystal
Tin	Asbestos (spinning quality)
Industrial diamonds	

C. PARTIAL DEPENDENCE ON FOREIGN SOURCES:

Antimony	Mercury
Arsenic	Nickel
Bismuth	Tantalum
Cadmium	Tungsten
Cobalt	Zinc
Chromite	Strategic mica
Lead	

Fig. 4. U. S. mineral position—Relative self-sufficiency of principal minerals.

ese and tantalum are relatively very small, but the output also has been small, so that in terms of production the reserve appears to be relatively large.

Fig. 3 shows the percentage of measured, indicated, and inferred reserves included in the total estimates of commercial reserves and reflects the relative certainty of the various estimates. For some commodities it was not possible, because of the nature of information available, to differentiate between measured and indicated reserves. Antimony, bauxite, cobalt, copper, iron, lead, gold, platinum metals, potash, zinc, mercury, and silver are included in this group. Measured and indicated reserves represent well over 50% of the total estimate for all of these minerals except cobalt, lead, gold, platinum, zinc, and mercury.

The Factor of Discovery

It was impossible to differentiate between measured, indicated, and inferred material in estimating the reserves of arsenic, bismuth, cadmium, manganese and sulphur. The greatest hazard attaches to estimates of inferred materials, and it must be observed that a large proportion of this class of reserve is included in the figures for chromite, cobalt, fluorspar, iron, lead, gold, platinum, tantalum, rutile, tungsten, vanadium, zinc, and mercury.

The uncertainty in mineral reserve estimates, however, is offset by the fact that no allowance has been made for future discoveries.

Fig. 4 is self-explanatory.

Techniques Are Improved For Aluminum Therapy

A. W. JACOB, Formerly Ventilation Engineer, McIntyre Research, Ltd., Schumacher, Ontario

In previous papers[1] Mr. Jacob discussed the dispersal of aluminum powder in change houses. In this article[2] the author discusses latest engineering aspects of silicosis prevention. It complements Dr. Robson's article on medical aspects of aluminum therapy, *E. & M. J., April, 1947.*

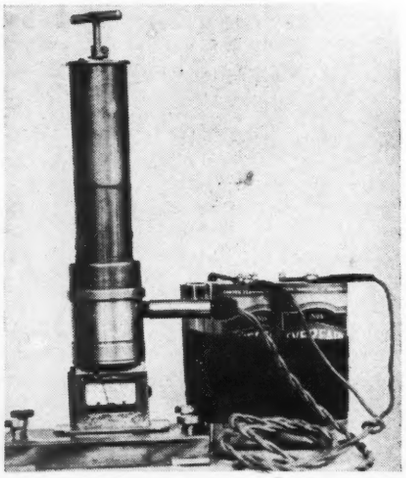


Fig. 1. New-type filter paper sampler used to estimate the concentration of suspended aluminum particles in mine change houses.

SINCE 1944, 73 mines in Canada and a few in other countries have installed the necessary equipment to prevent silicosis by the application of aluminum powder. Results of recent experimental work are set forth here together with an account of the means used to control this method.

The use of the preventative is controlled by patents held by McIntyre Research, Ltd. Before a license is granted to an industrial concern, assurance must be obtained that an honest effort is being made to provide adequate ventilation and suppress dust. This assurance is gained by personal inspection and information from a questionnaire. In addition, the agreement stipulates that these control measures may be re-examined at any time and, if not deemed adequate, the license can be revoked. This clause exists because increased amounts of quartz inhaled would require additional quantities of aluminum powder. Excessive amounts of any dust overload the mechanism of the lung which removes foreign substances. To guard against excessive consumption of aluminum powder, the amount being used is periodically checked against the prescribed quantity.

By these means, this organization will continue to do all it can to aid in the proper use and control of aluminum powder therapy.

A further reason for patents is to control the type of aluminum

[1] Jacob, A. W., E. & M. J., March 1946; also C.I.M. Trans. Vol. XLVII, 1944.

[2] Condensed from a paper presented before the Canadian Institute of Mining and Metallurgy, Jan., 1947.

Fig. 2 Filter paper sampler (in operator's hand) is calibrated with thermal precipitator.

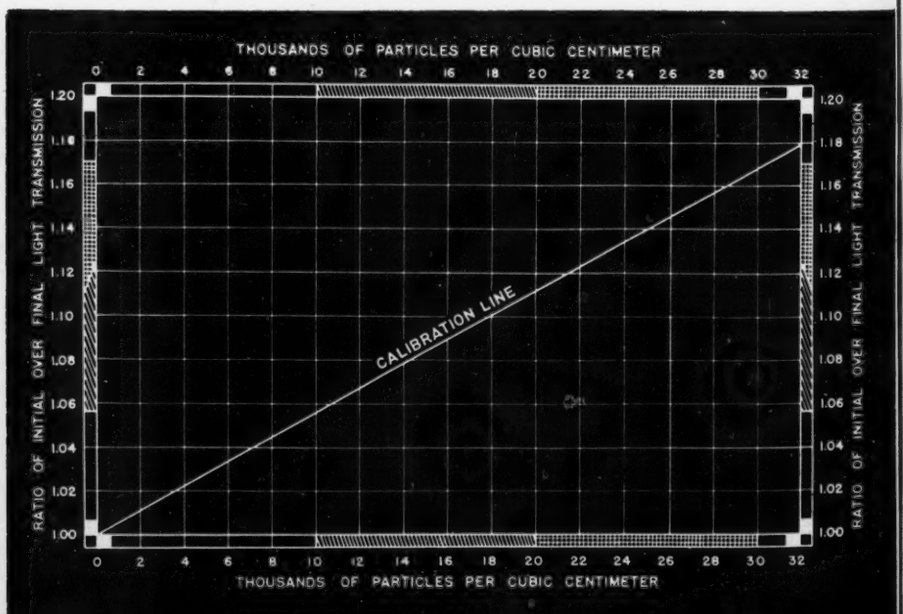

THOUSANDS OF PARTICLES PER CUBIC CENTIMETER
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32
RATIO OF INITIAL OVER FINAL LIGHT TRANSMISSION
1.20 1.18 1.16 1.14 1.12 1.10 1.08 1.06 1.04 1.02 1.00
CALIBRATION LINE
THOUSANDS OF PARTICLES PER CUBIC CENTIMETER

Fig. 3. Calibration chart for filter paper sampler. To use, calculate the ratio of initial to final light readings through the filter paper. Plot this figure on the chart. For a change house where men average a 10-minute treatment, the ratios should be in the squared section. For a 20-minute exposure the ratios should be within the hatched sections.

powder used. McIntyre powder is meticulously prepared from only the purest aluminum metals. Experiments have shown that even after being sealed in cans for three years, the powder does not differ from freshly ground powder. One percent of the powder (freshly ground or stored) decreases the solubility of silica in water 99%.

Supervision of the application of aluminum powder is maintained by collecting information prior to installation revealing all important conditions under which the powder is to be administered. The applicant's ventilation and dust control program must be approved first.

From this information, detailed recommendations are sent to the applicant. These include the number and location of the ejectors to be employed, the amount of powder to be used prior to each shift, and, where necessary, such alterations in the building as may be deemed advisable for proper application of the therapy. Copies of all the data are retained.

Powder Use Is Checked

To make sure that excessive amounts of powder are not used and to assure the user of ample supply, monthly record sheets are prepared showing the amount of powder on hand; delivered during a month; prescribed by McIntyre Research, Ltd.; and left on hand.

At the end of each year, a questionnaire is mailed to each licensee to ascertain the amount of aluminum powder actually used and on hand. This information is compared with our monthly records of the quantity prescribed. The comparison showed that, in 1945, the mines of Canada used more than 80% of the recommended amount of aluminum powder. This figure does not constitute the whole picture. It does not show how well the concentrations are being maintained over the whole treatment period in the change-houses. This can only be determined by inspection and investigation.

Inspection Trips

Inspection trips are made to each mine using aluminum powder. Unfortunately, at present, these visits are not as frequent as may be desirable because of a shortage of funds and personnel. The prophylactic concentrations of aluminum powder are checked with either the thermal precipitator or the filter paper sampler described in this article. In addition, dispersal technique, the conditions of treatment rooms, and the attitude of the employees toward the treatments, are noted. Management and medical personnel are acquainted with the latest aspects of the subject. If requested, talks are given to the employees. After the visit, recommendations are submitted to the mine management.

Supervision by Licensee

In the use of the aluminum preventive method, as in the application of ventilation, an educational program is essential. The employees are the ones receiving the benefits and they are also the ones who can nullify the expenditures by management on such measures. Some mines have included aluminum therapy in their course of instruction to new employees. This practice has been heartily endorsed.

If aluminum therapy is not properly applied and rigidly supervised, results will be disappointing to both industry and McIntyre Research. Industries throughout the world that have to do with silicosis materials await with interest the experience of Canadian mines in aluminum therapy. If results are not as expected, due to improper use, the only presently known medical method to prevent the development of silicosis will be discarded without fair trial. We hope, with the return of peace, that the cooperation between all interested parties, necessary to obtain complete beneficial results, will be achieved.

To aid in this respect, there will soon be available a simple instrument with which the concentration of suspended aluminum particles can be estimated. It is a filter paper sampler.

Filter Paper Sampler

This instrument was developed primarily at the Central Experiment Station of the United States Bureau of Mines in Pittsburgh, Pa., for general sampling purposes.[3] Briefly, it works on the principle that less light is transmitted through a dust-laden filter paper than through a clean one. A measured quantity of dust-laden air is drawn through the instrument by a hand pump. Light transmission through the filter, before and after the collection of dust on it, is estimated by a light meter. The ratio of these two measures then is compared with data which show actual dust concentrations determined by

[3] Brown, C. E., U. S. Bureau of Mines, R.I. 3788, Dec. 1944, 20 pp.

Fig. 4. Chamber for individual treatment. Apparatus connected to mouthpiece draws out samples of powder-laden air through filter papers. Quantity of suspended aluminum powder is determined this way.

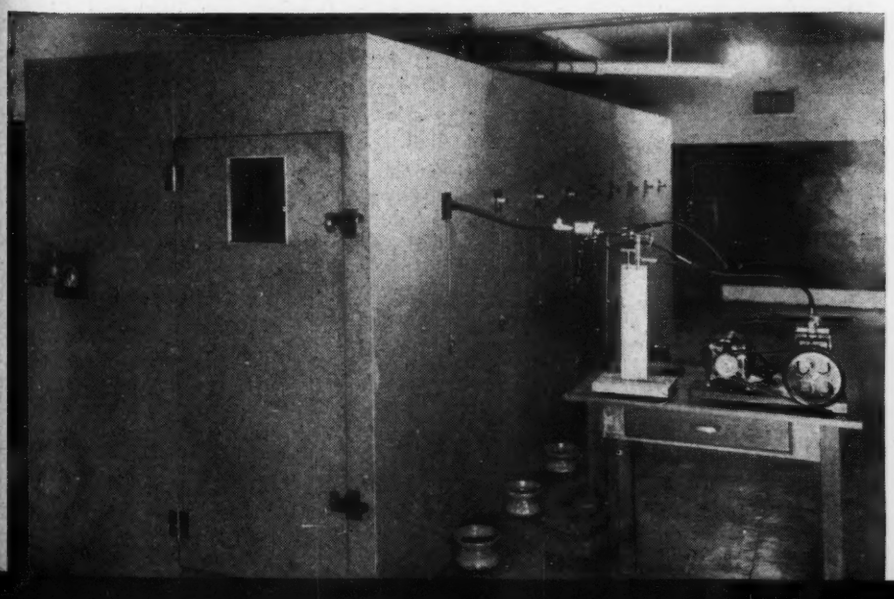
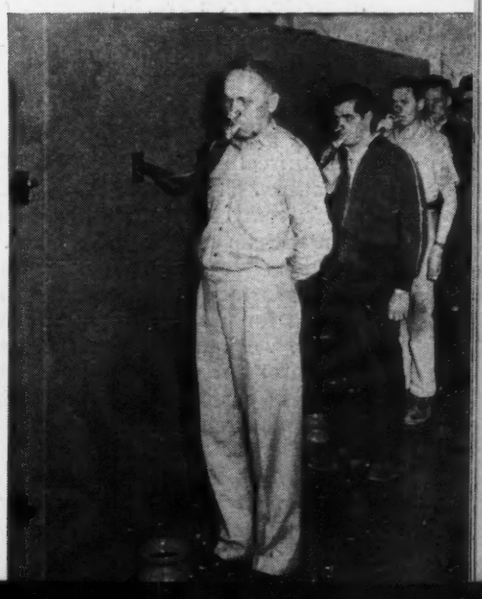


Fig. 5. Patients receiving aluminum powder from chamber. Treatment time is limited to 15 minutes.



RATIO OF INITIAL OVER FINAL LIGHT TRANSMISSION

more precise means. In this way, the number of particles present in the air being sampled is determined. The method, although quite approximate, is adequate in accuracy for the purpose in mind.

The instrument (Fig. 1) is of use in this way only where the particles being sampled have approximately identical size characteristics. The powder being used by McIntyre Research is of this type.

Some modifications of the original instrument were necessary to adapt it to our purposes. A rubber check valve was inserted to prevent air from being driven back through the filter paper on the return stroke. A built-in source of illumination enables air to be drawn directly through the instrument without subjecting air flow to a 90-deg. bend. The diameter of the filtering area was decreased one-half. Dry-cell batteries and a low drain bulb were adopted to maintain current variation at a minimum. A block, fitted with spirit levels, was added to the instrument to improve accuracy when reading the degree of light transmission.

To use the apparatus, a clean filter paper is placed in the holder, the photoelectric meter is attached to the head, and the instrument is then inverted on the levelling plate. Next, the lamp is illuminated and the amount of light passing through the filter paper is indicated by the light meter. The instrument is then detached from the light meter and the aluminum powder concentration is sampled by pulling air through the filter paper with ten strokes of the pump. Owing to the deposit on the filter paper, less light will pass through and a lower reading on the meter will result. The ratio of initial to final illuminations through the filter paper has been calibrated with the thermal precipitator in relationship to particles per cubic centimeter. (See Fig. 3.)

Calibration of Sampler

Fig. 2 shows the instrument in sampling position. Beside it is the thermal precipitator, with which it was calibrated. The chamber was used to control aluminum powder concentrations during calibration.

Previous to the experimental work performed to adapt this instrument for use in aluminum prophylaxis, we had only the thermal precipitator for estimating concentrations in change houses. This is a costly research instrument. It demands trained personnel, requires one hour to take, prepare and count a sample, and entails eye strain. On the other hand, the filter paper sampler is cheap, simple in operation, can be used to estimate concentrations in approximately three minutes, and entails no eye strain.

The instrument has been used successfully in field inspection trips to thirty-five Canadian mines. As soon as parts are available, manufacture of these instruments will be undertaken. It is the intention of McIntyre Research to supply each licensee, or where possible groups of licensees, with one of these instruments at cost price. They will then be able to measure their own concentrations, and make any necessary alterations to maintain adequate suspensions.

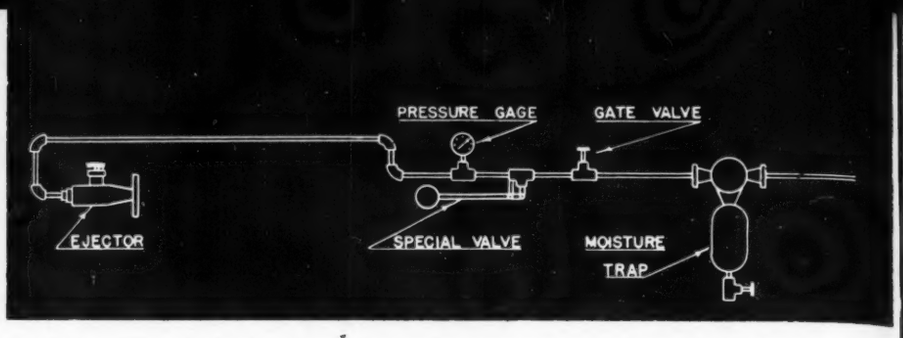


Fig. 6. Compressed air for dispersal of aluminum powder is controlled with this equipment.

Individual Treatment With Aluminum Powder

Up to the present point, this paper has dealt with the use of aluminum powder in change houses to prevent silicosis. It is now proposed to deal with some advances which have been made in the means to treat individuals with concentrated doses of aluminum powder.

The first silicotics who received aluminum powder treatment did so by inhalation from small aluminum mills[4,5]. Results showed that the powder, as administered by this method, alleviated their symptoms in a high percentage of cases. Since then, this procedure has been adopted for the treatment of employees in various industries dealing with siliceous materials.

As in the case of all new discoveries, continuous research develops improved methods of application. Our research along these lines tended toward the dispersal technique. It was evident from studies in mine change-houses that this procedure resulted in a suspension of the required particle size. As a result, a treatment chamber, using dispersal technique, has been developed to assure the following:

(a) A treatment will deliver a specified amount of aluminum powder to the patient's mouth.

(b) The amount of powder delivered is based on the average breathing rate of individuals at rest, namely, ten liters of air per minute.

(c) A patient, to obtain this amount, should not have to inhale from the chamber for a period longer than 15 minutes (an extended period would become too tiresome).

A unit, similar to the one about to be described, has been in operation during the past 18 months for the treatment of silicotics. This clinic has been established in Vancouver by the Workmen's Compensation Board of British Columbia. Satisfactory results are being obtained which will be reported in due time by the doctor in charge.

The Treatment Chamber

Fig. 4 shows the treatment chamber. It has inside dimensions of 19 ft. 7½ in. by 4 ft. 9 in. by 6 ft. in height. The volume of the room is approximately 560 cu. ft.

It is constructed of 2-in. by 2-in. floor sills, studs, and rafters, with a sub-floor of 1-in. shiplap. The inside walls, floor, and ceiling are covered with ¼-in. masonite, varnished. All joints are filled and all angles covered with cove molding. The outside walls are sheeted with ¼-in. masonite.

At one end of the chamber, a 2-ft. 4 in. by 5-ft. door enables the room to be entered and cleaned. Two latches and rubber tubing around the door frame provide an effective seal. Observation windows, 10 in. by 12 in., are situated 5 ft. high, one in the door and one directly opposite in the other end of the room. Illumination is provided by a centrally located fixture.

Nine aluminum tubes, spaced at 2-ft. centers and at a height of 4

[4] Crombie, D. W., Blaisdell, J. L. and MacPherson, G., Jour. Can. Med. Assoc., April, 1944.

[5] Hannon, J. W. G., C. I. M. Trans., Vol. XLVII, 1944, pp. 180-184.

TIME FROM END OF DISPERSAL IN MINUTES

ft. 3 in. from the floor extend to the inside wall of the chamber. No. 5 rubber stoppers effectively seal their openings when the tubes are not in use.

A special ejector with a ½-in.-diameter inner nozzle was designed to decrease the discharge distance in order to minimize impingement of powder on the inside walls of the chamber. The discharge orifice was welded to a plate on the outside of the room. Dispersal is made through a flared opening in the wall, to minimize impingement.

Fig. 6 shows our compressed-air control arrangement. Compressed air is supplied to the ejector through ½-in. standard pipe. It is cleaned by a moisture trap. A pressure gage and gate valve control the discharge pressure allowed for dispersal. A special valve enables the full discharge pressure for dispersal to be obtained instantaneously.

At the opposite end of the room to the ejector, a 12-in. square ventilation pipe, equipped with a damper, connects the ceiling of the chamber to a wall fan. This removes the remaining suspended powder after each treatment period.

Apparatus Used

For experimental purposes, this chamber has been sub-divided into two sections by a partition and a door (similar to that already described) at two-thirds the length. For the experiments reported hereafter, the larger section, having six inhalation tubes, was used.

Fig. 4 depicts the experimental apparatus for sampling the quantity of aluminum powder suspended in the chamber. In choosing the equipment, it was necessary to bear in mind that the amount of powder-laden air to be drawn from the chamber during a test was 10 liters per minute. To do this, a Pressovac No. 4 pump connected to a flow-meter, graduated in liters, was used. A clamp on the rubber tube connection regulated air flow. The flow-meter was connected to a Seitz filter containing two No. 40 Whatman filter papers. The inlet end of the filter was connected to an aluminum mouthpiece with a butterfly inlet valve and the outlet valve sealed with a No. 5 rubber stopper.

Experimental Procedure

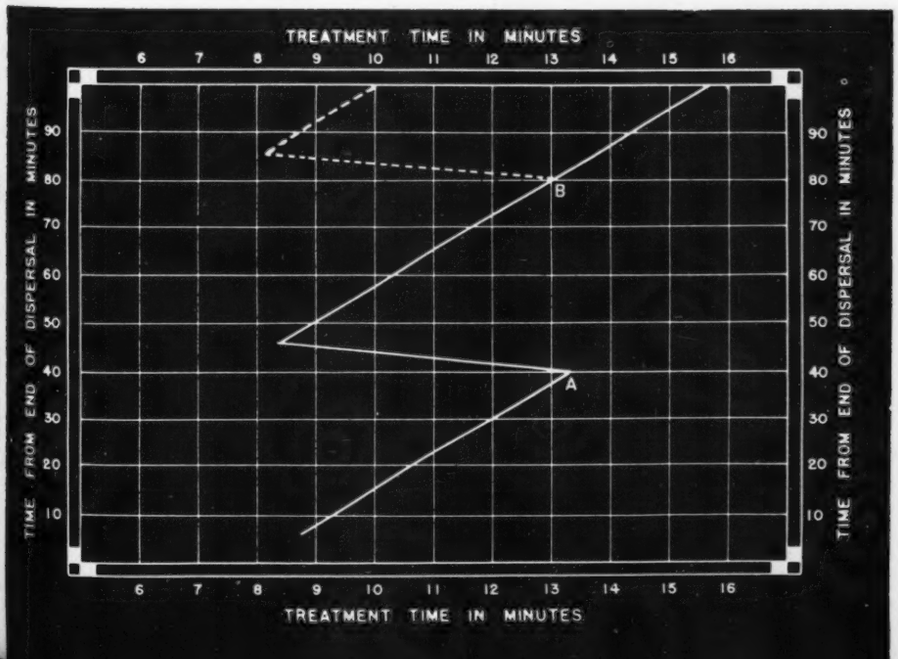
The door of the chamber and the damper in the ventilation pipe are opened and the fan is turned on. The moisture trap on the compressed-air line is blown, and the air left on until dry. Two No. 40 Whatman filter papers are weighed to the nearest one-tenth of a milligram; then by means of tweezers, they are placed in the Seitz filter. The wing nuts on the filter are tightened uniformly. Next, the discharge pressure of the compressed air through the ejector is regulated to 40 psi. The door and the damper in the ventilation pipe are closed. The fan is turned off. All the inhalation tubes are sealed with No. 5 rubber stoppers. The first can, containing exactly 10 grams of aluminum powder, is placed in the ejector, pierced, and the plunger removed. Starting at 15 sec., the compressed air is turned on and left on for 30 sec. A 45-sec. interval is allowed during which the next can is prepared for dispersal. Two such cans are dispersed in an identical manner. Thus it takes 1¾ min. from the start to finish the dispersal. The time is noted.

The sampling apparatus is connected to the inhalation tube being tested. Two minutes after the dispersal of the powder has been completed, the first test is begun, the pump is started and set at 10 liters per min. The test runs for ten minutes, during which time the flow of air is kept constant by regulating the clamp. At the end of this period, the pump is stopped, the clamp is closed tightly and the Seitz filter is disconnected. The inhalation tube being used for sampling is sealed with the rubber stopper.

Ten minutes is allowed, during which the filters are removed with tweezers and placed on the balance pan. Any powder on the inside of the Seitz filter is brushed onto the sample. The latter is then weighed and the result recorded. Two new filter papers are weighed in readiness for the next sample, and the test is continued. At 39½ min. from the end of the first dispersal, the contents of a third similar can are discharged in the same manner.

After six samples have been obtained, the chamber is opened up and the remaining suspended material removed by the fan. Many such tests have been performed.

Fig. 7. Treatment chart to control amount of aluminum power inhaled. Nurse can determine treatment time for patients at various instants after powder has been dispersed. New dispersals take place at A and at B (dotted line).


TREATMENT TIME IN MINUTES
6 7 8 9 10 11 12 13 14 15 16
TIME FROM END OF DISPERSAL IN MINUTES
90 80 70 60 50 40 30 20 10
B
A
TREATMENT TIME IN MINUTES

Discussion of Results

Fig. 7 shows the average settling rate for the treatment chamber as determined from the tests on the inhalation tubes. This chart is based on the delivery of 50 mg. of powder to a patient's mouth. The nurse can regulate the time of treatment for each patient to attain any desired part of this amount. When a patient arrives for treatment, the nurse, by a simple calculation on the chart, determines the length of treatment necessary to assure the delivery of the determined amount of powder to his mouth.

The dotted line on the chart illustrates the effect of adding another 10-gram can of aluminum powder at 40-minute intervals from the end of the first dispersal. This demonstrates that the concentration of aluminum powder in the chamber can be maintained for an ex-

tended period. It provides also such a continuous high concentration that the time of treatment is short and, therefore, not tiresome to the patient.

The quantity obtained from each inhalation tube will vary to some extent. The variation is of minor significance when compared with the difference in retention from patient to patient.

Samples were collected with the thermal precipitator from the mouthpiece while 10 liters of air per minute were being withdrawn. To be most effective the aluminum powder must be as fine as the finest silica particle, that is, under one micron. The product from the treatment chamber reaching the patient's mouth fulfills this requirement.

The thermal precipitator is able to sample a wide range of dust concentrations. This is so because variation may be practised in the amount of air drawn through the instrument. However, the concentration of aluminum powder in the inhalation tubes from the treatment chamber is so great that it has been impossible to devise a technique to count the particles. Thus, the particles per cubic centimeter suspended inside the chamber are not known.

Fig. 5 shows patients receiving treatment from units of this kind. With this size of chamber, 20 patients can be treated simultaneously. Smaller or larger chambers may be used. The method is advantageous either for prevention or for treatment of large numbers of employees where closed changehouses are impractical or unavailable. Where a constant source of compressed air is not available, small portable compressors or bottled air could be used. The method is simple, involves no moving parts, employs a powder of standard quality, and is economical.

In conclusion, I want to emphasize the following points:

1. The use of aluminum therapy is an adjunct to ventilation and dust control for the prevention of silicosis.
2. The powder herein described, whether freshly ground or canned, remains unchanged over a three-year period with respect to size characteristics when suspended in the atmosphere by recommended dispersal technique; chemical composition; metallic aluminum content; and ability of the powder to decrease the solubility of quartz in water.
3. For good results the recommendations laid down by McIntyre Research, Ltd., should be practised. The provision and maintenance of suitable suspensions of aluminum powder for either the mass treatment of individuals or for special individual treatments must be carefully supervised.
4. The filter paper sampler is ideal to estimate the suspensions of aluminum powder used in silicosis prevention. It is recommended that each mine, or where possible, group of mines, obtain one of these instruments for routine use during treatment periods.
5. The method of using the treatment chamber here described is an improved way of administering aluminum in concentrated dosages to certain individuals. It may be employed in industries and/or places where closed change houses are infeasible or unavailable. It is advantageous for the treatment of large numbers of individuals simultaneously. Also, it can be adapted to either the prevention or treatment of silicosis.

Rock Drill Oil May Help Or Hinder Your Flotation

E. C. HERKENHOFF, American Cyanamid Co., Stamford, Conn.

MILL MEN have long recognized that lubricating oils and greases can definitely affect flotation circuits, usually adversely. In general, mineral oils tend to flatten froths, pull gangue, and destroy selectivity; but in some cases small amounts of mineral oils have been found beneficial. More often, however, mineral oils are both accidental and undesirable components of flotation pulps.

Where such oils regularly leak or spill into the ore in the mill itself, corrective measures are usually simple; but where the oil comes from rock drills or other mine equipment, the mill man has little control, even though troublesome amounts of oil may be handed to him with the ore.

So far as I know, there is nothing in the literature on consumption of rock drill oil in underground mining. My purpose here is to present data on this subject which show that: (1) Rock drill oil is consumed in amounts capable of affecting flotation. (2) The presence of such amounts in the ore does definitely affect flotation.

How Oil Enters Ore

Among the possible sources of mineral oil contamination underground are: rock drill exhausts; air-driven loader exhausts; leaking bearings on cars, locomotives, or hoists. Pneumatic rock drills are by far the most important source.

Many miners supplement the lubrication from their drill's line oiler by additional doses of up to a pint or so of oil poured into the air hose before connecting it to the drill, both before and during a drilling cycle. All this oil eventually exhausts into the mine atmosphere or is discharged as an emulsion with the drill water and cuttings. Not all this oil ends up as an ore contaminant, but the major portion certainly must, particularly in workings such as drifts and shrink-

Table I. Rock Drill Oil Consumption at Several Western Underground Mines

Data for 6-month period, November 1940, to May 1941

Mine	Total Excav. in Tons	Tons of Ore	Gallons of Oil Used	Calc. Pounds of Oil Used in Ore	Pounds of Oil Per Ton of Ore
A	404,323	297,572	8,250	44,933	0.151
B	330,657	214,689	4,243	20,377	0.095
C	336,776	204,915	4,070	18,315	0.089
D	162,822	96,693	1,650	7,252	0.075
E	161,898	67,685	1,200	3,715	0.055
F	238,450	157,354	1,474	7,516	0.048
G	193,527	86,785	1,179	3,909	0.045
H	449,158	288,358	2,550	12,114	0.042
I	446,749	290,003	2,546	12,227	0.042

Average was 1,704,054 tons of ore at 0.0765 lb. of rock drill oil per ton.

Table II. Data on Factors Affecting Rock Drill Oil Consumption at Mines Listed in Table I

Mine	Lbs. of Oil Used Per Ton of Ore	No. of Primers Per Ton	Lbs. of Powder Per Ton	Avg. No. of Drills Operating Per 10,000 Tons	Avg. Width of Completed Stope, Ft.
A	0.151	0.1092	0.290	7.7	5.5
B	0.095	0.0837	0.208	5.6	7.0
C	0.089	0.0639	0.143	5.0	12.4
D	0.075	0.0918	0.221	4.4	8.0
E	0.055*	0.0835	0.185	6.2	5.8
E	0.055†	0.0835	0.185	6.2	7.0
F	0.048	0.0605	0.120	4.6	9.9
G	0.045	0.0790	0.157	5.5	8.7
H	0.042	0.0554	0.156	4.9	12.4
I	0.042	0.0683	0.152	5.0	10.0

* Type 1 ore. † Type 2 ore.

age stopes where drilling goes on over broken ore.

To get some idea of how much oil is used in underground mines, data on consumption over a six-month period of normal operation were obtained from several large Western mines, which embody all commonly-used methods of stoping. Quantities of rock drill oil consumed were obtained from clerk's records; ore tonnages came from the engineering departments. The data for consumption of oil per ton of ore, given in Table I, were calculated under the assumption that all the oil ended as a contaminant, and that the degree of contamination for ore and waste was the same.

How Much Oil Used

The consumption ranged from 0.042 to 0.151 lb. of oil per ton of ore, which is similar to the 0.02- to 0.20-lb.-per-ton range for most flotation reagents. It should be remembered that the data in Table I are average figures for entire mines; in certain individual stopes and workings, the consumption undoubtedly is much higher. I have seen some poorly ventilated working places where the miners were also having rock drill trouble, and so much oil had been used that it had collected in puddles and films on the pools of water. Oil concentration on ores from such places would run much higher than average.

The use of rock drill oil is proportional to the amount of drilling done, a relationship that is brought out in Table II. Here the number of primers used per ton of ore is taken to indicate the number of holes drilled and shot. Powder consumption is also indicative of quantity of oil used, and width of stope is a factor, the oil consumption apparently increasing as the stope width decreases. A separate study of proportions of ore in stopes, raises, and sills led to the conclusion that oil consumption is not influenced thereby.

Effect of Oil

Flotation tests were then run to determine whether or not lubricating oil, in the quantities indicated by the data of Table I, would affect flotation. The rock drill oil selected for testing, which was used extensively in the mines listed in Tables I and II, had the following characteristics:

Gravity	20.2 API
Flash (Cleveland cup)	370 deg.C.
Pour point	0.20
Viscosity, 100 deg.	487
Viscosity, 210 deg.	61
Neutralization number	0.65
Saponification number	21

Blown rape seed oil added

A series of preliminary tests was run in 1941, at the University of Idaho through the courtesy and under direction of Prof. J. E. Newton. Freshly-exposed, oil-free ore from a stope in Mine "D", Table I, was used. It was a complex sulphide containing largely quartz, chalcocite, bornite, pyrite, and minor amounts of galena and chalcopyrite. The average head assay was: copper, 8.5%; iron 13.8%; lead, 1.2%. Where used, the rock drill oil was added to the grinding mill; all other reagents to the conditioner. Techniques and results appear in Table III.

Small amounts of this rock drill oil increased the recovery of both copper and iron, especially the latter, for example, in Test 3, Table III. Even in tests employing xanthate under non-selective conditions, the oil caused slight but definite increase in copper and iron recoveries. Lead assays are shown for some tests, but lead recoveries were not computed because of erratic calculated head assays. Those lead assays shown are intended to explain in part the varying ratios between copper and iron assays.

Because preliminary work had shown that small amounts of rock drill oil could affect flotation, additional tests were later run on a variety of ores in the laboratories of American Cyanamid Co. In all cases, a blank, or comparison, test was run, followed by tests using rock drill oil.

Tri-State Lead Ore. The sample was a Tri-State ore carrying galena and chalcopyrite in a carbonate gangue. It was ground to minus 65 mesh and floated with pine oil, and both with and without the collector, Reagent 343. Oil at

MILLMEN SHOULD KNOW just what effect oil from rock drills like this one (note oil can) has in their flotation cells

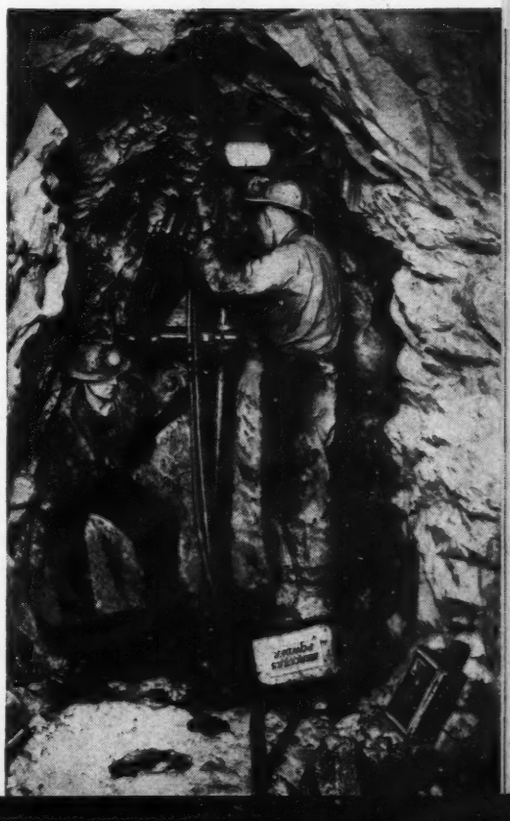


Table III. Results of Preliminary Flotation Tests Using Varying Amounts of Rock Drill Oil

Test No.	Size of Charge, Gms.	Reagents, Lbs./ton* Pine Oil	R. D. Oil	Lime	Xan.	Concentrate Assays, % Pb	Cu	Fe	% Recovery Cu	Fe
1	2000	0.13	——	——	——	9.1	20.7	6.5	20.1	3.9
2	2000	0.13	0.03	——	——	8.6	23.9	11.3	26.1	8.4
3	2000	0.13	0.14	——	——	4.5	22.1	19.1	62.6	33.5
4	500	0.062	——	——	——	16.5	24.6	8.2	12.2	2.7
5	500	0.062	0.070	——	——	4.7	29.9	13.9	41.5	12.2
6	500	0.062	——	0.40	——	6.3	18.1	9.6	16.1	5.5
7	500	0.062	0.070	0.40	——	4.5	23.9	15.6	46.2	21.3
8	500	0.062	——	0.40	0.02	——	18.7	24.9	92.8	82.2
9	500	0.062	0.070	0.40	0.02	——	17.7	24.9	95.8	87.4

* R. D. Oil designates Rock Drill Oil.
Lime designates Hydrated lime
Xan. designates Sodium ethyl xanthate.

In all tests, ore was crushed dry to minus 10 mesh, and where used, rock drill oil was added to dry ore and well mixed before wet grinding. This procedure simulated conditions in actual practice. Samples of 2,000 grams and 500 grams were then tested, using a 10-min. ball mill grind and a 10-min. rougher flotation period. In both series, blank tests were run using pine oil alone, and the procedure was then repeated on ore mixed with rock drill oil. All reagents, except the oil, were added to the flotation cell.

Small amounts of rock drill oil increased recovery of copper and iron, especially the latter. This was true even when using xanthate.

Table IV. Bad Effect of Rock Drill Oil on Flotation of Complex Ore

Test No. 1 was blank test; No. 2 carried 0.18 lb. per ton oil in rod mill.

Test No.	Product	Wt., %	Assay, % Pb	Zn	Cu	Distribution, % Pb	Zn	Cu
	Head	100.00	2.70	5.14	0.42	100.00	100.00	100.00
1	Pb-Cu Conc.	6.82	37.25	12.14	4.67	94.25	16.11	76.06
	Zinc Conc.	8.88	0.80	44.85	0.65	2.63	77.49	13.87
	Tailing	84.30	0.10	0.39	0.05	3.12	6.40	10.06
	Head	100.00	2.86	5.48	0.44	100.00	100.00	100.00
2	Pb-Cu Conc.	10.70	24.80	20.60	3.53	92.76	40.19	84.56
	Zinc Conc	9.39	1.10	32.29	0.39	3.60	55.29	8.28
	Tailing	79.91	0.13	0.31	0.04	3.64	4.52	7.16

Southwestern lead-zinc-copper ore containing galena, sphalerite, chalcopyrite, pyrite, and marcasite in quartz and sericite gangue. In addition to assays given above, ore carried 12.47% iron and 61% insol.

Test Procedure:

Sample ground in rod mill to 0.12% plus 65 mesh, 44.1% minus 65 mesh. Reagents to mill included: calcium hydroxide, 1.0; sodium cyanide, 0.5; zinc sulphate, 1.5; all lb./ton.

Sample then to cell at 23% solids, conditioned 1 min. with Aerofloat 31, 0.10 lb./ton; pine oil, 0.03 lb./ton. Lead-copper rougher floated for 2 min.; pH was 7.4.

Tailing conditioned 11 min. with: copper sulphate, 1.5; calcium hydroxide, 1.5; Sodium Aerofloat, 0.10; pine oil, 0.03; all in lb./ton; the last two added at 10 min. Zinc rougher floated for 5 min.; pH was 10.4.

0.09 lb. per ton went to one test with collector, and oil at 0.18 lb. per ton was used in one test without collector. The oil lowered the grade of concentrate 4 and 7%, respectively.

Tri-State Zinc Ore. In testing a cherty Tri-State zinc ore by standard methods, addition to the conditioner of 0.09 lb. per ton of rock drill oil made little real difference. The froth using oil was slightly weaker, but both grade of concentrate and recovery improved somewhat upon using oil.

Complex Sulphide Ore. On a lead-zinc-copper ore from the Southwest, containing galena, sphalerite, chalcopyrite, pyrite, and marcasite, in quartz and sericite, lead and copper were floated first using cyanide, zinc sulphate, Aerofloat 31, and pine oil. Zinc was then floated with copper sulphate and Sodium Aerofloat. In one of two identical tests, 0.18 lb. per ton of rock drill oil was added to the rod mill. The oil produced a dirty, weak, large-bubble froth in the lead-copper float and brought up much pyrite in the zinc float. As can be seen from Table IV, an excessive amount of zinc wound up in the lead concentrate, and separation in general was poor.

Gold Ore. A South American gold ore containing native gold, pyrite, hematite, limonite, and bornite in quartz was floated using copper sulphate, reagents 208, 301, and pine oil. Froth on the comparison test using 0.09 lb. per ton rock drill oil was unchanged. Recovery and grade were increased slightly using oil.

Results Differ

The foregoing tests show that rock drill oil can be beneficial or detrimental to flotation, depending on the kind of ore, reagents used, and type of separation sought. Bulk flotation, for example, seemed least affected. In any case, the oil does have a definite effect in the amounts used.

The nature of the oil is, of course, all important. The oil tested here contained rape seed oil; other lubricating oils carry special emulsifying agents or similar additives that may be expected to affect flotation more strongly than the relatively inert hydrocarbons of the oil itself.

Apparently the question reduces itself to a problem for the individual operator, and an investigation of it would seem justified by the foregoing tests. Certainly if a particular ore and oil combine to upset the flotation circuit designed for that ore, an operator ought to know it and take what measures he can against it. Conversely, if an oil is beneficial, the operator should know about that too. Definite information on the effect of oil on his ore would arm many a mill superintendent against the alibi of a "miner dumping his oil bottle," and it might help explain some of those mysterious "changes of ore" which sweep through a mill from time to time.

Suggested Remedies

If the particular oil used in the mine is found to be troublesome, test other lubricants until one satisfactory to both mill and mine is found. If this is impossible, study the problem underground, enlisting the aid of the mining department. For one thing, if miners are pouring excessive amounts of oil into air hoses, try to get that practice stopped. It is not only bad for flotation, it may gum up the machines and hoses. After all, rock drills must have proper lubrication, but too much oil is both wasteful and injurious. If your test work proves your point, the mining department will listen to your plea for control of careless or wasteful use of lubricants in the mine.

Borehole Cable Installed To Cut Power Bills

L. J. BATTEY, General Electric Co., Salt Lake City, Utah

WHEN ENGINEERS of the Silver King Coalition Mines Co. encountered a large flow of water in the west end section of their mine in Park City, Utah, recently, they had to provide additional electric power for an ultimate underground pumping load totaling 2,000 hp.

Power was being fed to the west end section of the mine from two sources, both from the same 44-kv. power company system:

a. Through an 8,000-ft., 3-conductor, 2/0, 2.4-kv. cable down a 1,300-ft. shaft and through the mine tunnel.

b. Through a 12,000-ft., 3-conductor, 300,000-cir. mil, 2.4-kv. cable through another tunnel.

Line Losses Averted

Transformer capacity on the surface was ample for both sources, but the long cables would not carry this additional load. If additional cables had been installed to parallel either of the two power sources, the initial cable cost would have been high, as large copper conductors would have been needed to reduce line drop. The losses in these long cables would have been great, and at approximately $0.01 per kwh. would have represented a heavy annual charge against pumping. It was decided, therefore, to drill an 8-in. borehole for the power cables.

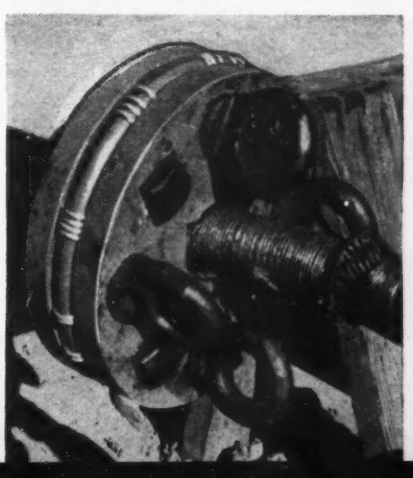
A suitable point was selected in a canyon which was only 1,300 ft. above the tunnel through which the "b" cable ran. A vertical borehole was drilled here, to intersect this tunnel about 12,000 ft. in from the portal and at a point about 400 ft. from the west end station.

By going over a high ridge, it was necessary to build only 1½ miles of 44-kv. line from the main mine substation to the top of the borehole. A 2,000-kva. step-down bank of transformers was installed, and the power was taken down the borehole at 2,400 v. through about 1,700 ft. of cable. If the tunnels had been used, it would have been necessary to install either 8,000 or 12,000 ft. of cable. It was estimated that in three to four years' operation, savings in cable losses alone would pay for the 44-kv. substation, the 1½ miles of high line, drilling of the borehole, and cable and switchgear.

It is expected that at one cent per kwh. the cables if fully loaded will save from $8,000 to $12,000 per year as compared to costs to conduct electricity through the two possible alternate routes mentioned.

CABLES are suspended permanently over these sheaves. Lead shims were inserted between the cables and the sheaves when the latter were set in final position.

THREE-PLATE ARMOR CLAMP attached 35 ft. from the upper end of the cable shown after assembly.



Because of the length and weight of the cable to be hung in the borehole, it was decided to use three 2/0 cables instead of one or two larger ones. After considering several types of cable and methods of supporting it, 3-conductor, 2/0, stranded, varnish cambric, insulated, lead-covered cable was selected. Galvanized wire armor was used, with asphalt protective coverering, and 4-in. wire bands applied over the armor every 35 ft. Net weight of the cable was about 8 lb. per ft. The outside diameter was 2.16 in. The vertical section of each cable in the borehole weighs 5 tons. To support each cable from the top only by the armor, an 11-in. in diameter, 3-plate, armor clamp with a 2¼-in. hole was made.

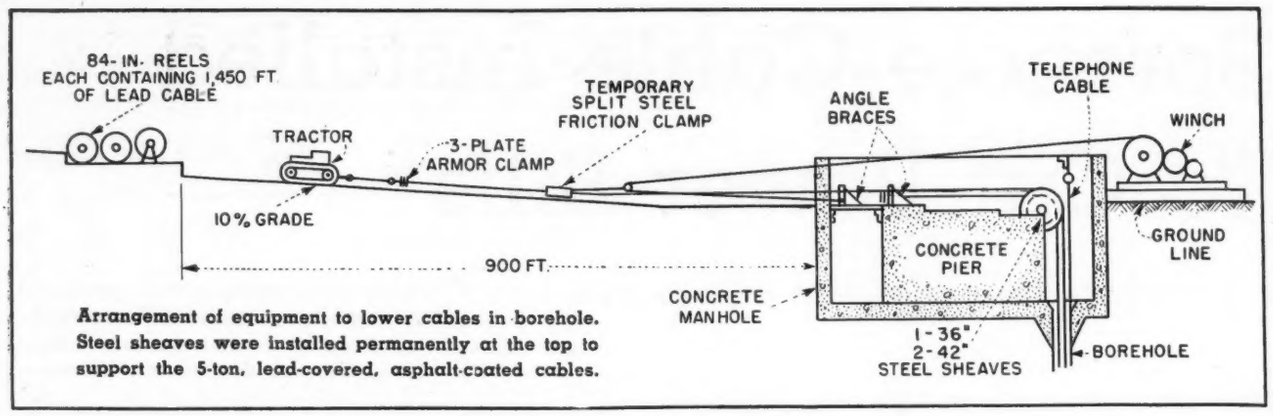
Sheaves Prevent Slipping

To prevent copper conductors from slipping inside the lead, the cables were lowered over one 36-in. and two 42-in. inside diameter sheaves, made from solid 3-in. boiler plate with half-round grooves cut on the rims slightly larger than the outside diameter of the cable. The cable will hang permanently over these sheaves, with the three-plate armor clamps in the horizontal run of the cable near the sheave. The 5-ton weight of cable on the 90-deg. arc of the sheave firmly anchors the copper conductors.

A rough roadway was prepared from the borehole 900 ft. up the canyon against a 10% grade. A level platform was built for the three 84-in. reels which held 1,450 ft. of cable each. One reel was jacked up. A tractor then pulled 900 ft. of cable to the borehole.

Next, a jacketed mine telephone cable was lowered to permit constant telephone communication between the top and bottom of the hole while the cable was installed.

Then a weighted, ⅜-in., steel messenger cable was put down the hole. This was fastened to the first power cable, which was started down the hole by means of a small winch back of the manhole. (See in-



Arrangement of equipment to lower cables in borehole. Steel sheaves were installed permanently at the top to support the 5-ton, lead-covered, asphalt-coated cables.

stallation drawing.) The steel cable of the winch was fastened to the cable by split-steel friction clamps.

After lowering 100 ft. of cable, the friction clamp was moved back to a new position. About 550 ft. of cable was lowered in this manner, and during this time no braking was provided other than the friction of the cable stretched out on the ground. A winch at the bottom of the hole took up the slack in the messenger cable.

When the upper end of the cable was off the reel about 50 ft., the three-plate armor clamp was put on the cable 35 ft. from the end, as this was the distance from the manhole up to the potheads on the substation. The cables were not spliced between the borehole and the surface substations. A large temporary split-wooden friction clamp was put on the cable at the borehole, and braced against wooden timbers to eliminate any further possibility of movement.

The three-plate clamp was then connected to the tractor with four eye-bolts and a special cable sling. The sling had three spreaders to support the 35 ft. of cable trailing back of the armor clamp. This prevented whipping around and breaking the exposed portion of the lead near the clamp.

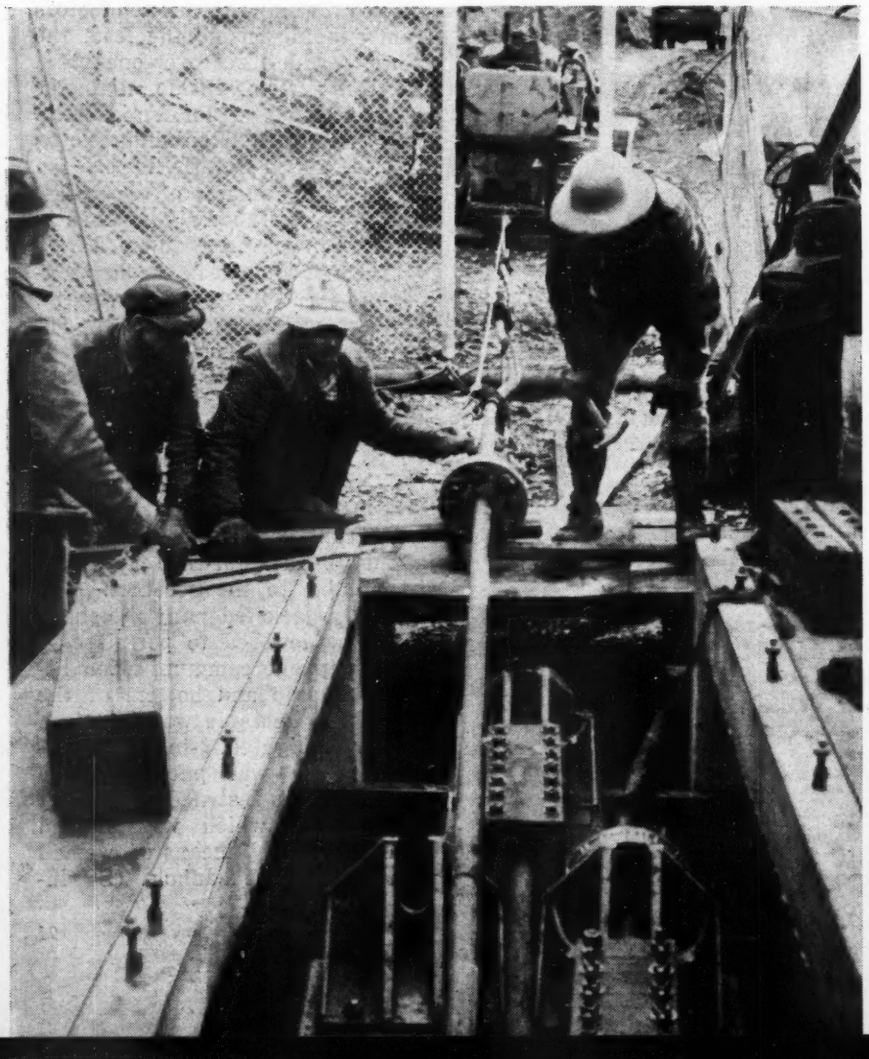
It was then necessary to use the drop winch to pull about 200 ft. more cable into the hole to get sufficient weight to move the 700 ft. of cable lying on the ground. Then the tractor backed slowly toward the hole, lowering the cable at a rate of about 40 ft. per min. The armor clamp was eased into position against the slotted steel angle bracket which was bolted to the concrete pier in the center of the manhole. A lead shim was inserted between cable and sheave as the final position was reached. The eight nuts on the armor clamp were all faced to exactly the same thickness, to insure even distribution of the load against the angle bracket.

As an additional safeguard, a permanent, bolted, split-wooden friction clamp was put on the cable between the bracket and sheave and fastened to the bracket with two "J" bolts with a clevis on one end. (See illustration.)

After the first cable was down, it was decided to dispense with lowering a weighted messenger cable ahead of the second because of the possibility of the two cables becoming fouled. Instead, the weight was fastened onto the end of the second.

The second and third cables were then lowered. A light grease was applied with brushes as the cable entered the hole. No trouble was experienced in getting the third cable through the hole, with the first two already in place.

This method of lowering and supporting the cable was worked out by Frank Stone, master mechanic of the mine, who supervised the entire installation.



LAST CABLE being lowered to final position. Note three-plate clamps resting against slotted angle braces, also bolted split wooden clamps attached to two cables on right to give added support to the suspended cables.

Bureau Inspects Old Shafts With Portable Headframe

NORMAN EBBLEY, JR.[1]

IN MAY, 1946, the Bureau of Mines began investigation of old mine shafts and adjacent accessible working in the Leadville area in Colorado, as part of a project originally started to outline orebodies to be drained by the Leadville tunnel, and to assure proved zinc carbonate reserves for a Waelz-type fuming plant proposed by the Metallurgical Branch. The project was continued to investigate reserves above present water level, and to encourage the production of lead and zinc sulphides and carbonates, and zinc and manganese oxides. This program undertook to ascertain the extent of manganosiderite reserves and to obtain samples of these and other types of complex ores for metallurgical research. Information was obtained for owners disclosing the condition of these old workings.

Portable hoisting equipment here illustrated was built at the Bureau shops in Leadville. The hinged tower, constructed of tubular steel, folds back over the cab of the truck and rests on the top gantry of the frame. A small hand winch raises and lowers the tower. Normally the unit can be spotted near a shaft and put into operation within an hour.

Three different types of buckets were designed before an acceptable one (in the center of the accompanying illustration) was devised. Double-deck construction permits two men to be lowered at the same time. This narrow, double-deck "go-devil" was excellent for narrow shafts because the man on the upper deck could operate the bell cord while the man on the lower deck could steer, and keep the "go-devil" from twisting or hanging up on any obstructions.

Where shafts must be repaired either by lagging or by cutting through obstructing timber, the narrow construction of the "go-devil" is particularly helpful because the man on the lower deck can work around and below the platform. Maximum diameter of the double-deck cage is 24¾ in., and total length is 15 ft. It is reinforced and has a bonnet of ⅝-in. boiler plate.

Adjustable steel legs attached to the rear corners of the truck body eliminate vibrations which might occur if the boom were supported by the truck springs only. Length of the boom is such that the rear truck wheels can be spotted 22 ft. from the center of the shaft.

Cord for Signalling

A ⅛-in. galvanized bell cord fastened to a bell at the top of the tower is unreeled from a spool as the bucket is lowered in the shaft. This line is stapled to timber as the cage makes its first trip down. The reel is disconnected and mounted at the lowest level to be investigated. Upon completion of a job, the cable is reeled up on the last trip out of the shaft.

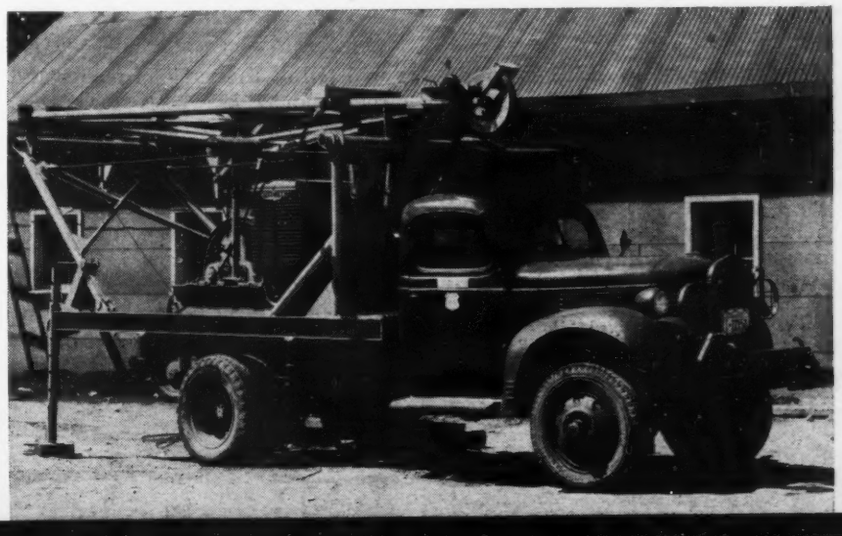
During May to September, 1946, 33 shafts and accessible workings from these shafts were investigated. Workings were surveyed, mapped, and all ore occurrences sampled. Approximately 75% of the investigations were made at the request of property owners or lessees.

Although most of the shafts have not been used for 20 to 40 years, they were still in fairly good condition. However the work is hazardous and requires utmost caution at all times.

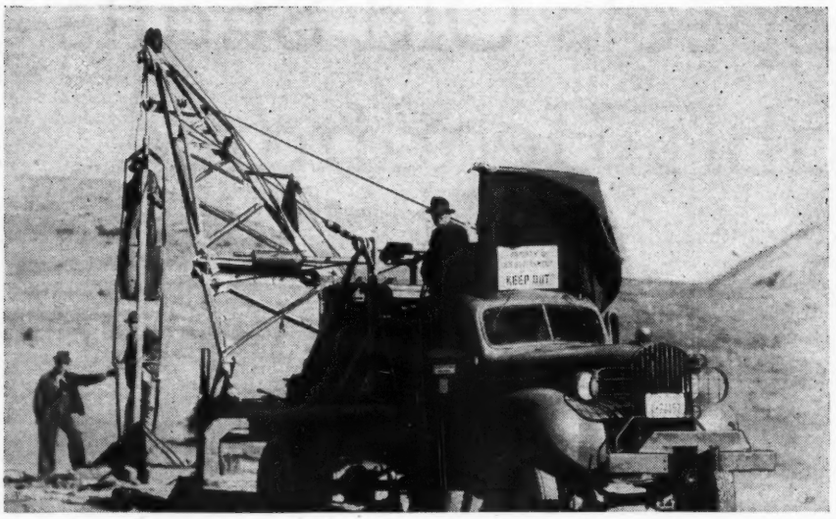
Investigation procedure is as follows: 1. Spot portable hoisting unit near collar of shaft, level machine, and elevate the tower. 2. Repair the collar and make it safe for descent. 3. Start the first inspection down the shaft with candle and carbide lights to test for CO_2 and oxygen deficiency, removing all obstructions and other timber on the way down. 4. Investigate all accessible workings and levels. 5. sketch accessible workings by Brunton survey. 6. Sample all orebodies and zones of mineralization, obtaining samples for metallurgical testing also. 7. Upon completion, submit to owner or lessees a short report including all pertinent facts gathered by the Bureau. These data do not include recommendations, but include sample analyses and a sketch map.

Some shafts were more than 1,000 ft. deep and accessible workings totaled several thousand feet in length. In investigating shafts with indicated low oxygen content and probable accumulations of CO_2, an experiment utilizing aëration with falling water proved success-

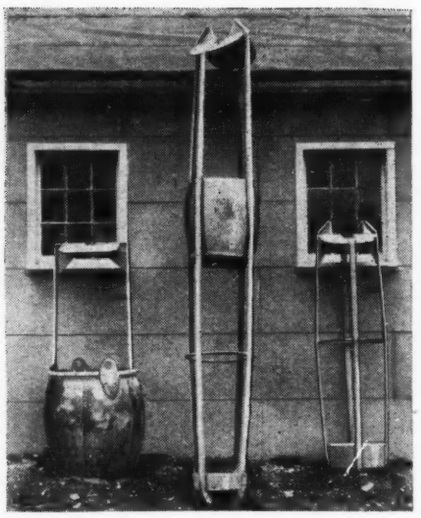
PORTABLE HEADFRAME UNIT consists of a Vulcan No. 21½ hoist powered by a Continental gasoline engine mounted on a "four-by-four" 1½-ton Army cargo carrier. The drum carries 1,200 ft. of ⅝-in. non-rotating wire rope. Hoisting capacity is 2,750 to 3,000 lb. Complete unit was constructed at cost of $2,523.34.



[1] Mining Engineer, U. S. Bureau of Mines, Salt Lake City Division, Mining Branch. Published by permission of the Director, Bureau of Mines, U. S. Department of Interior.



DOUBLE-DECK "GO-DEVIL" ready to go down shaft. Men signal hoistman on truck with bell cord which is reeled out as cage descends. Tower is raised into operating position by small hand winch. Whole set-up takes less than an hour to complete.



CENTER UNIT proved best for shaft examinations after other two types had been tried. Note safety bonnets on cages.

ful. On the first trip down the Fairview No. 4 shaft, neither candles nor carbide light would burn at a depth of 65 ft. below the collar. By removing the cover, the normal circulation after two days permitted men to be lowered to 125 ft. Then 400 gal. of water was poured down the shaft through a fine mesh screen to break the stream. This spray carried fresh air down the shaft with it and apparently absorbed considerable CO_2, which was formed by slow oxidation of the rotting shaft timbers. Water at zero deg. C. absorbs 1.71 times its volume of CO_2. After this experiment in aëration, men were lowered to a depth of 200 ft. and examined a lower level 100 ft. from the shaft with no ill effects. In old stopes devoid of circulation, a Wolf-type safety lamp is used to test for methane. So far, none has been encountered.

Assisting in the investigation of shafts is an underground crew of three men, including John I. Schumacher, assistant engineer, and a surface crew of two—a hoistman and a helper.

Finding and Mining Optical Calcite Crystals

CLARENCE R. KING, Consulting Mining Engineer, Box 210, Santa Ana, Calif.

Observations of many occurrences suggest some rules for prospecting. Extraction and preparation have to be delicately done.

MY EXPERIENCE in helping to develop a supply of optical calcite in northern Mexico to meet the wartime demand for this mineral which resulted from the invention of new types of fire-control equipment, yielded a great deal of useful information which I have used as the basis for this second article.[1] Here I will tell of the various places and circumstances in which the optical calcite was found to occur and state a theory as to the origin of this interesting mineral, together with facts supporting this theory of mineral formation. Some rules for prospecting will follow and a description of the procedure used in extracting the crystals from the productive vugs without damaging them and in preparing and grading them subsequently for the market.

In northern Mexico, productive deposits of optical calcite have so far been found only in or near Tertiary volcanic rocks; principally rocks of medium to basic composition such as dacite, andesite, or basalt; in veins traversing flows, dikes, or tuffs of this composition. No productive deposits are known in limestone, shale or other sedimentary rocks, nor in metamorphic or plutonic rocks. All occurrences known are founds in vugs within or close to the walls of calcite veins or chimneys; the vein filling in most cases being opaque massive to crys-

[1]The first article, entitled "How a Sudden Demand for Optical Calcite Was Met," was published in E. & M. J. May, 1946, pp. 80, 81.

talline calcite with minor amounts of opaline silica.

In some cases the vein filling away from the productive vugs is transparent and of the Iceland spar variety, but due to growth strains or earth movement after deposition, is completely permeated with strain twinning or incipient fractures, or both. Crystal of optical or suboptical grade has been found only as holomorphic crystals lining the walls of open fissures or vugs. These vugs may be completely open, or may be completely or partially filled by later infiltration of fine white "caliche" resembling flour; or the later filling may be red clay. In a few cases crystal growth inward from the walls has been so great that noticeable open vugs are absent, the crystals grown from the walls having met or nearly met.

Product of Hot Springs

Apparently, a narrow temperature-pressure range is favorable to the formation of Iceland spar; and that zone was very close to the surface at the time of the growth of the crystals. Iceland spar may be spoken of as the bones of dead hot springs; and in the productive districts opened to date, without exception, there is still hot spring activity close by.

From the evidence gathered it may be assumed that the formation of Iceland spar crystals took place under the following conditions: ascending heated water carrying a small amount of calcium carbonate in solution, making its way toward the surface through an open fissure or pipe, upon reaching the surface (hot spring) with the attendant sudden drop in pressure and temperature would tend to choke the vent by sudden and almost complete precipitation of all dissolved material. This would result in open cavities a short distance below the surface, filled with stagnant or slowly moving, alkaline hot water carrying (in the case of the deposits in question) principally calcium carbonate in solution. Iron still present in the form of hydrates would slowly settle toward the floor of the vug, and Iceland spar crystals would begin to slowly grow from both walls toward the center. As long as conditions remained unchanged, growth of crystals unmarred by growth bands (mechanically deposited films of iron oxide or clay), superposition of crystals (a sudden acceleration of the rate of growth of the crystals), would continue. A small change in the delicate balance of pressure, temperature, concentration, or flow velocity of the water in the vug would immediately be reflected in the crystals depositing therefrom, in the form of strain twinning; growth bands; clouds (precipitated calcite or silica dust); bubbles (gas or liquid inclusions); or superposition.

Crystals May Be Large

Uniform crystals weighing up to 400 or 500 lb. have been found. When this is the case, most of the crystals in that particular vug are very large, and uniformly yield a high percentage of good material. In other cases crystals may be large but exhibit five or six stages of growth; that is, after initial growth, the velocity of the passing hot water suddenly increased (probably by reopening of the hot-spring vent), depositing a film of mud (iron oxide or clay or colloidal silica) upon the faces of the growing crystals. Upon later slowing of the rate of flow of the growth bath, the growth continued, resulting in crystals exhibiting bands of clear Iceland spar separated by "mud seams."

The foregoing theory of the formation of Iceland spar fits the facts so far known, which are:

1. Iceland spar in Mexico is found only in or very near the younger volcanic rocks.

2. Without exception there is today, or there is evidence that there was recently (geologically speaking), hot-spring activity near the known deposits of Iceland spar.

3. In the only deposit where depth has been attained, it appears that erosion had barely reached the top of the system of vugs carrying the crystals, and these vugs show evidence of the crystals giving way to massive opaque calcite wall lining at about 100 ft. in depth, with opaline silica appearing in relatively large amounts. In this case the entire temperature-pressure range of the deposition of Iceland spar is available for study. The best crystals were near the top of the vug system, and were almost entirely scalenohedrons with basal terminations; very uniform and without superposition and growth bands. With depth, simple rhombic twins, distorted scalenohedrons, and occasional basal plates appeared; as did pointed scalenohedrons. With further depth, silica deposition appeared and Iceland spar crystals were fewer; finally giving way to opaline silica and opaque massive calcite wall lining of the vugs at a depth from the surface of approximately 150 ft.

4. All productive deposits known to me occur where erosion has removed not more than a few hundred feet, at most, of the veins since their formation. In several deposits old hot-spring vents are noticeable on the same veins, but a hundred feet or so above the outcrops of workable vugs.

5. No productive deposits have been found in limestone or other sedimentary rocks other than recent or Pleistocene gravels associated with basalt flows. Nor have any productive deposits been found in the older metamorphic or plutonic rocks.

Experience indicates that the practical rules to follow in prospecting for calcite veins bearing Iceland spar are these:

1. Favorable areas comprise the middle to upper series of Tertiary volcanic rocks, at or near centers of hot-spring activity (and as inaccessible as possible to judge by results in northern Mexico).

2. Calcite veins, usually outcropping prominently, should be minutely examined for transparent Iceland spar float, usually small rhombs and fragments weathering out of exposed tops of possible productive vugs. While it is probable that many blind spar-bearing vugs exist, unless erosion has exposed the top of the vug and good crystal is weathering out at the surface, the chances of hitting a productive vug by blind development on a calcite vein are about on a par with the chances of winning the Irish sweepstakes.

Results Uneconomic

During the early stages of the program, considerable prospecting and mining was done in Montana. From the standpoint of pounds of acceptable material produced per hundred dollars of prospecting and mining expense, or per foot of development work, the results were uneconomic by any standard except that of a critical war emergency.

3. Once float is found, digging should be concentrated on the soft and low spots near by in or on the sides of the vein outcrop; that is, the vug or *abra* outcrop will be found to be filled with caved surface

material mixed with broken crystal.

4. Massive, wide sections of the veins are unfavorable places in which to encounter vugs except on the walls. A wide vein traced to a point where it "fingers" out into many stringers or where a pronounced change in strike is apparent may produce at those points. In general, however, most of the productive vugs have been found in smaller, more discontinuous veins, from a few inches to 3 or 4 ft. wide.

Extracting the Crystals

Once a productive vug is found and opened, actual mining is done entirely with hammers, moils, gads and bars. It is not wise to use dynamite within 15 ft. of usable crystal. The shock will usually internally shatter all crystal within that radius. Prying the crystal loose by wedging with gads and moils between the roots of the crystal mass (which are always twinned and useless) and the vug walls is the best method. At times a square yard or so of wall lining will loosen. A mat of timber and grass is propped against the section; it is then pried loose from the wall, and gently lowered to a horizontal position for separation of the individual crystals. Extraction requires a great deal of patient and skillful hand labor, at which the Tahaumara Indians of the Sierra excel. The operation may in many respects be compared to the extraction of recalcitrant, impacted, and fragile teeth; the pain being felt by the producer when a hammer slips and several hundred dollars' worth of crystal is destroyed.

Once removed, the crude crystal is rough-cleaved to remove the obviously useless material; packed in grass or palm fiber and transported to the nearest receiving point by muleback or Indian power. About 1 to 10% of the crude crystal was acceptable as sub-optical. Much less is of optical grade. During the program of production of sub-optical material, a grader periodically visited the receiving points (usually one or two in each district). These were accessible by truck or plane. The field grader finish-cleaved the crude crystal, removing all the useless material possible without destroying good crystal; weighed, packed and shipped the acceptable material. Settlements were made on the spot. Packing was carefully done: each piece of crystal was wrapped in newspaper, palm fiber, or kapok, whichever was most abundant at the receiving station; and the material tightly packed in boxes holding approximately 60 lb. Each box was stamped with a code number designating the locality, the mine from which the crystal originated, and date received.

Cleaving to remove defects requires a simple set of tools, but plenty of experience and good eyesight. The ability to visualize in three dimensions and a knowledge of the "habits" of the crystal, as well as great manual dexterity, are necessary to work through 2 or 3 tons of crude crystal in a day, from which 120 to 400 lb. of acceptable material is cleaved.

The cleaving is done by shock. A thin-edged sharp chisel of the proper weight and width with respect to the crystal is placed parallel with the desired cleavage, and the crystal is split with a single blow of a hammer of proper weight. Chisel sizes range from ¼-in. to 2 in. in width, the length and weight being in the same proportion as in the ordinary mechanics' cold chisel. Hammer weights vary from about 4 oz. for ordinary crystal weights, up to a short-handled 16-lb. hammer for cleaving crystals weighing above 100 lb. The important thing is that the crystal be cleanly split with one properly placed blow; otherwise shattering and loss of good material will result. In fast work, a great deal of cleaving is done with a specially made hammer with one thin chisel edge at right angles to the line of the handle; the crystal being held in one hand, and a properly applied single blow from the chisel edge of the hammer cleaving the piece cleanly at the desired point. This method requires extreme dexterity and much practice, but cleaves cleaner and permits faster work than is possible with chisel and hammer.

Proper Light for Grading

Lighting is important when working fast: the best field set-up is a bench about waist high, set in a uniform slight shade with diffused sunlight about 4 ft. in front of the bench. A north light is to be preferred. Grading can be done in sunlight or in shade, according to preference; the important thing being that the intensity of the light remain constant while grading is being done. One grader, under the best conditions, can keep three men busy bringing crude crystal, taking away and packing acceptable material, and cleaning up rejects; and up to 3 tons of crude crystal can be cleaved and graded in eight to ten hours of hard work.

Incipient fractures, twinning, clouds, growth lines, inclusions, and color must be instantly spotted, correlated with respect to the cleavage planes and the useful part of the crystal; and the defects cleaved off without pause. When the piece is apparently free from defects, it is given a quick turn to catch reflections from overlooked fractures or twinning, and if free from such defects and of the required size, is placed in a box for further inspection and packing.

Grading for Optical Spar

The foregoing applies to the field grading of sub-optical calcite. In the selection for optical-grade spar, less than a fraction of 1 percent of the crude crystal will conform to the rigid specifications. Pieces of crystal that after careful inspection appear entirely clean to the unaided eye in bright sunlight are segregated for further study. Final selection of high-grade optical Iceland spar is done in a dark room, with the use of a high intensity pencil of light and under magnification. The principle of detecting microscopic defects, principally minute clouds or bubbles (fractures and twinning have long since been eliminated by the unaided eye) is the same as the well-known procedure for detecting colloids in solutions. If the field selection has been performed by an experienced man, about half of the apparently clean field-selected calcite will pass these tests and be suitable for the manufacture of Nicol prisms, range-finder prisms, saccarimeter elements, and the like.

One effect of the war program using sub-optical calcite has been to reverse the production-consumption relationship outlined in the first part of this article. At present, as a byproduct of the large production of sub-optical calcite, the principal users of optical calcite in the United States have stocks on hand greatly exceeding their immediate needs, which has been reflected in a substantial cut in the price offered for this material. Most of this present stock of "high-grade" came from northern Mexico. Africa also produced much optical and sub-optical calcite toward the end of the procurement program.

War Damage, Obsolescence Problems for French Mines

MICHAEL MARSH, Paris Bureau, McGraw-Hill World News

RELEASED FROM THE BONDS imposed on them during the German occupation, mining companies in France and French territories are in a ferment of experiment, centering largely about application of mechanical scrapers and loaders and development of flotation systems. Armed with dollar credits made available through U. S. loans, French mines have placed many orders for U. S. equipment and more such orders are expected. As the following survey indicates, French iron, lead-zinc, phosphate, and potash mines are hard at work trying to regain or improve their former positions.

Iron's Position

French iron deposits lie in three zones: the Lorraine basin; the Normandy-Anjou-Brittany region; and the Pyrenees section. Yearly production normally runs about as follows: 30,000,000 tons, 2,000,000 tons, and 250,000 tons, respectively.

The Lorraine iron occurs in seams 1.5 to 6 meters thick at an average depth of about 300 meters. Grade is about 32% Fe with sulphur running less than 0.2%. The mining method used involves laying out a system of 100-meter squares throughout the property, then mining out each square by a modified room-and-pillar method. Liquid oxygen is used as the explosive. Air hammer drills are standard, but electric rotary drills are being tested as possible replacements. Joy, Eimco, and Thew shovels are used in these mines and about 60% of French iron ore is now scraped or loaded mechanically.

Iron mines in Normandy suffered heavy damage during the invasion, unlike the Lorraine mines, which were not harmed by the war. Normandy, out of action since 1944, only began to produce iron ore again in 1946.

Table I shows how iron production has fallen off since the war ended. Actually there is little incentive to increase production at once, because there is only enough coke available to smelt the iron ore now being mined. Note how production per man-shift has fallen off, an effect apparently of poor nourishment for workmen. There are now about 20,000 men in France's iron mines against 29,000 in 1939.

Table I—Effect of War on French Production of Iron Ore

Data in thousands of metric tons

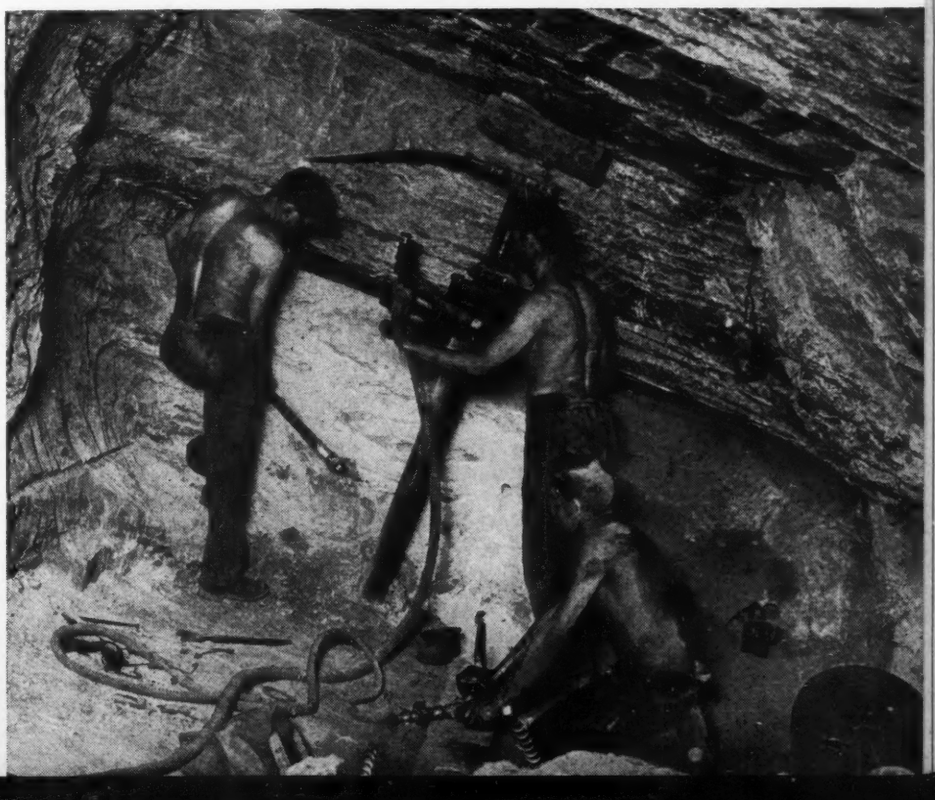
Year	Field				Avg. Output Per Man-Shift (met. tons)
	Lorraine	Normandy	Pyrenees	Total	
1939	30,588	2,083	147	32,817	4,878
1940	12,985	1,207	120	14,312	3.761
1941	19,587	747	162	20,496	3.640
1942	23,521	1,313	159	24,993	3.986
1943	30,566	1,224	142	31,932	4.539
1944	18,589	316	108	19,013	3.355
1945	7,370	210	112	7,692	2.194
1946*	11,154	442	104	11,700	

* First 9 months.

Lead-Zinc Flotation

The great shortage of lead and zinc in Europe in recent years has caused much development work at the various small mines in France of the Société Minière et Metallurgique de Peñarroya. This company's largest mines are in Spain, but little information concerning them was available in Paris, where this review was prepared.

Moroccan lead output is expected to increase greatly. The Aouli mine resumed production in October 1946 and should turn out about 1,000 tons of galena monthly in 1947. With other operations being ex-



ALSATIAN POTASH lies in two seams at depths varying between 500 and 1,000 meters. The upper, shown here, averages 1.5 meters thick, carries 22 to 25% K_2O; the lower, 2 to 5 meters thick, carries 15 to 20% K_2O. Men are shown using old-type cutter and drill, which are to be replaced with modern high-capacity equipment from American manufacturers.

Table II—Metallurgical Data and Reagents for Penarroya's Pyrite-Arsenopyrite Separation at Ceilhes, France

Product	Tonnage met. tons/day	Composition, % Pyrite	Arseno-pyrite	Sulphur	Arsenic	Recovery, % Pyrite	Arseno-pyrite
Feed (zinc tailing)...	100	26	9.5	17	4.4		
Final tailing.....	70	10	5	7	2.4		
Bulk concentrate....	30	67	20	40	9		
Pyrite concentrate...	18	85	4	47	2	58.8	16.4
Arsenopyrite conc....	12	39	44	30	20	18.0	55.5

Point Added	Reagent Quantities in Lb./Ton of Zinc Tailing: Sodium amyl Xanthate	Copper Sulphate	Pine Oil	Sodium Silicate	Potassium Permanganate
First rougher cell.....	0.29	0.26	0.04	1.59	
First scavenger cell...	0.15				
First cleaner conc.....	0.03		0.01		
First re-cleaner tailing	0.03				
Second re-cleaner cell					0.11

panded, Moroccan production in 10 years may reach a total of about 50 or 60,000 tons of galena concentrate yearly.

Pyrite from Arsenopyrite

An example of technical progress is the recent introduction of four-stage flotation at Peñarroya's Orb mine at Ceilhes, France, where 1,900 tons of ore are treated monthly to produce, as concentrates, 120 tons of galena, 150 tons of sphalerite, 250 tons of pyrite, and 120 tons of arsenopyrite. Peñarroya leased this mine in 1943, but only recently modernized the 20-year-old mill.

In the new mill, ore is ground to minus-80-mesh and galena and sphalerite floated by standard methods. The zinc tailing is then washed in slime cones to eliminate lime, which hinders pyrite flotation. Cone underflow goes to a 14-cell MS machine for bulk flotation of pyrite and arsenopyrite. This concentrate is cleaned once, then is treated in a 10-cell "Minemet" machine that yields, by repeated cleaning, a pyrite concentrate and an arsenopyrite tailing for insecticide use.

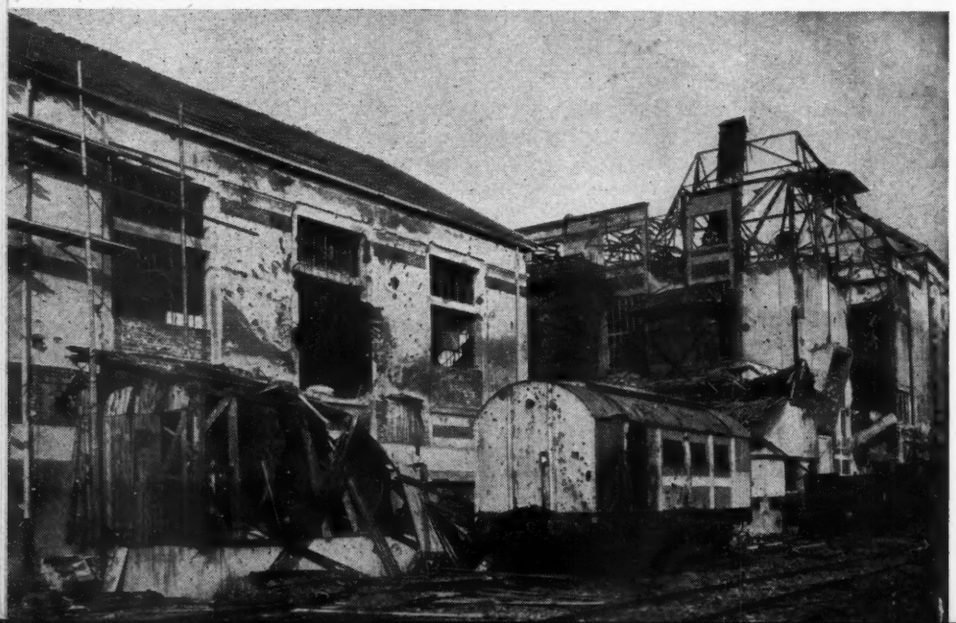
Basis of this separation is that arsenopyrite floats less easily than pyrite and is further inhibited by an oxidizing agent such as the $KMnO_4$ actually used. Metallurgical data and reagents are given in Table II.

A four-product process is also to be applied in 1947 to Peñarroya's Pierrefitte mine in the Pyrenees. This is a 50-year-old mine that was reconditioned in 1942 with new scraper set-ups, electric haulage, and new mill equipment, most of it American. With the new process, pyrrhotite and magnetite will be produced as well as galena and sphalerite. Plant capacity is 6,000 tons of ore per month.

Table III—Present Distribution of German Potash Mines Among Allied Zones of Occupation

Zone	Number of Mines	Production, 1943 met. tons K_2O	Percent of Total German Production
Russian...	17	1,009,000	61
British....	11	328,300	20
American..	2	243,300	15
French....	1	55,200	4
Total....	31	1,635,800	100

THE ANNA MINE in Alsace was the target of an air attack in 1945. Its headframe and surface plant were wrecked, as shown, and the mine is said to be flooded. No opinion is available as to when, if ever, the mine will be rehabilitated. The Ensisheim mine, near by, is in a similar state as the result of dynamiting by the retreating Germans.



Alsatian Potash

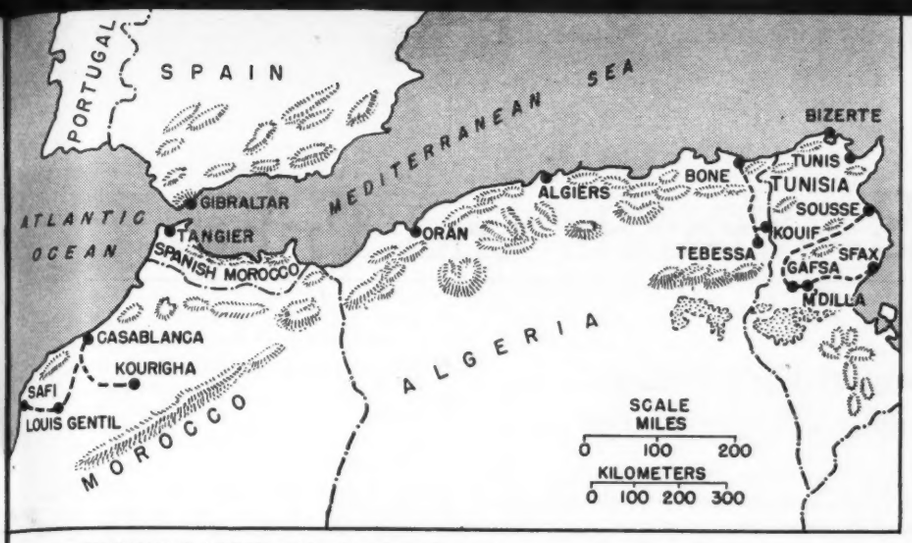
After the fluctuations of the past seven years, the Alsace potash mines, second in the world only to the German mines, have now steadied out at a rate higher than prewar. Only two mines were still out of action early this year, and large-scale modernization programs are planned for all properties. These plans amount to a revolution in both mines and concentrators, and they are based on American machinery and a $3,000,000 credit established by the French Government.

Alsatian ore comes from 16 mines lying just north of Mulhouse. The ore is sylvinite (mechanical mixture of sylvite, KCl, and halite, NaCl) found in two layers in Oligocene sediments at depths varying between 500 and 1,000 meters. At present a long-wall mining method on 150-meter faces is used. Broken sylvinite is hand-loaded on shaker conveyors. Ore is hoisted in ½-ton cars on cages. On surface, some of the crude salt is crushed to 4-mm. and sold directly as mixed salt. The remainder is purified by differential crystallization.

Under the improvement plans, mechanical loaders and more powerful drills and cutters will be used. Wider tracks, 10-ton cars, and skip hoists will be installed. Flotation will probably replace crystallization as the KCl recovery process. By these means, it is hoped to raise output to 850,000 tons of K_2O content by 1950, double the present rate.

Turn-About

With most of the German mines reported closed and with 60% of Germany's potash capacity in the Russian zone (see Table III), Alsace should become increasingly important in world potash markets.



PHOSPHATE MINES in North Africa lie within the area shown here. Largest deposits are in Morocco; only two of six known (Kourigha and Louis Gentil) are worked. Dotted lines show railroads to seaports. In east, mines worked at Gafsa, M'Dilla, and Kouif suffered war damage.

This is one more example of the rapid turn-about of events during the wars.

In 1940 the invading Germans turned all Alsatian mines over to a major German producer which proceeded to work the mines intensively and wastefully. Production reached new peaks, but machinery was driven mercilessly and mine development was neglected. The Germans mined only the richer upper seam, ignoring the effect on the lower seam's roof and on the course of future work. This treatment, plus the fact that the mines happened to be located right in the middle of the battle of the Colmar pocket in 1945, have made a modernization program essential to restore productivity.

French Phosphate

The phosphate mines of French North Africa, which in 1939 produced 30% of the world's output, are back on the international market in full force, and several are in the midst of intensive modernization programs. In the first nine months of 1946 deliveries in tons from the principal producers ran as follows:

Morocco	1,700,000
Gafsa (Tunisia)	827,000
M'Dilla (Tunisia)	220,000
Constantine (Algeria)	180,000

In 1939 the Moroccan mines produced only 1,700,000 tons of phosphates in the whole year, and satisfied with present output, the Moroccan company plans no great attempt at modernization. Mines in Algeria and Tunisia, however, have ordered much American equipment, especially loaders, and plan also to try flotation.

Algeria

The Constantine mine in Algeria gets its phosphate from three seams, each 0.6 to 1.3 meters thick and separated by thin layers of gangue. The rock is quite hard and is blasted with liquid oxygen. Present methods use long-wall mining and hand-loading, but room-and-pillar mining and mechanical loading will be tried, despite the probable loss of the advantage of hand sorting at the face. The miners now sort out gangue for stope filling.

Electric locomotives haul ore in ½-ton cars to a central point, where an 1,800-meter endless chain pulls the cars to the surface. Ore is then sorted, crushed, dried, and some of it is enriched by an air winnowing process that blows away some of the lighter gangue. Flotation will be tried if water supplies can be found. The mine's phosphate is shipped from Bone, 260 km. north, where port facilities, damaged by bombing, have been replaced.

Tunisia

Phosphate mining in Tunisia suffered more war damage than elsewhere in North Africa. Both Tunisian companies, Gafsa and M'Dilla, ship their rock via the 250-km. Gafsa railroad to the port of Sfax, and during the Tunisian campaign, the Americans swung around on Rommel's flank and fought a battle near Gafsa. As a result, the railroad bridges were bombed out, the boilers of many of the 46 locomotives were burst by strafing, and portions of the trackage were scattered. Worse still, the port facilities at Sfax were bombed and the supplementary port at Sousse was completely wrecked. Altogether about $4,000,000 damage was suffered, and it took many months of reconstruction by the American and British North African Joint Economic Mission before deliveries could again be made in quantity. The port of Sousse has been abandoned permanently.

The Gafsa mines resemble the Constantine in situation and methods, except that phosphate is field-dried instead of furnace-dried. It is planned to mechanize the mines, and diesel-electric locomotives are on order for the railroad.

Morocco

Office Cherifien des Phosphates, sole Moroccan producer, is a corporation wholly owned by the Moroccan State. Its present expanded output has been achieved without opening new mines or applying new techniques, the impetus having been applied by the greater demand resulting when other North African sources were cut off by the war.

Although six phosphate deposits are known in Morocco, and all of them appear quite rich, only two are now being worked; one near Kourigha and one near Louis Gentil. Estimates of reserves are vague because of the vastness of the orebodies. In the Kourigha deposit alone there is probably 130,000,000 tons of 75% phosphate rock in one seam in the northeast section. If ores of 70% phosphate are considered, the company believes that Moroccan reserves could supply the world for several millennia.

This Kourigha seam averages 1.8 meters thick and lies 20 to 30 meters down. It runs 75% tri-calcium phosphate. The Louis Gentil deposit, opened in the early 1930's, is believed to contain the world's largest reserve of 70% rock. Conditions here resemble those at Kourigha except that the roof is poorer and the seam slopes a little.

Moroccan phosphate is not really rock at all, the seams being so sandy that the phosphate can be picked out by hand. Mining is thus a hand operation in open stopes. Battery-powered locomotives and endless-rope haulage are used.

As mined, the Moroccan phosphate is wet as well as granular, the Kourigha ore carrying 15% and the Louis Gentil ore carrying 13% moisture. Brought to processing centers, the ore is dried and screened as at the Constantine mine, and is shipped from Casablanca or Safi.

MARKETS—Trends and Prices

Suspension of Copper Import Duty Brings Widespread Price Confusion—Silver Lower

INTEREST IN MAJOR non-ferrous metals centered chiefly in copper. Contrary to expectations, price confusion in the metal prevailed throughout May, owing primarily to a difference in opinion on the ability of the market to absorb another sharp advance in the price at a time when sentiment among consumers appeared to be undergoing a marked change. Opposition to higher commodity prices emanated from Washington, and this development, along with the threat of another boost in wage rates, did not pass unnoticed.

Consumers purchased a substantial tonnage of copper, beginning May 6, at both 21½c. and 24c. per pound, Valley basis, the top figure obtaining on foreign metal. Our weighted average quotation fluctuated over a wide range daily, complicating matters no end for brass and wire mills. The E.&M.J. average for copper sold in the domestic market during May was 22.105c. per pound, f.o.b. refinery, against 21.225c. in April.

A custom smelter, the American Metal Co., was the first to move in disposing of foreign copper to domestic consumers at 24c., Valley, or at import parity. Shortly thereafter the American Smelting & Refining Co., also a custom smelter, and Anaconda Sales, representing the leading Chilean producer, followed suit. Kennecott continued to sell its domestic production on the old basis of 21½c., and Phelps Dodge billed copper to its subsidiaries at the same level. Several smaller producers either sold at 21½c. or at the E.&M.J. average. Metals Reserve continued to release copper from its dwindling stocks, but shifted to the average price basis as soon as the market became snarled up in a two-price trading basis. This situation was foreseen in contracts agreed upon some time ago when it was evident that at some not-too-distant date the program of Metals Reserve would gradually come to an end.

As May ended, those consumers who had encountered sales resistance in their products at the 21½c. price spoke openly of their displeasure over the action of the copper market and declared that they would reduce their inventories and substitute other materials for copper if at all possible. The brass industry was particularly outspoken over the critical price situation. The fact that aluminum has become plentiful at comparatively low prices was disturbing to fabricators of brass where competitive conditions have been restored.

Scrap copper, usually more sensitive to market conditions than the primary metal, weakened toward the end of the month and was available at prices substantially below price differentials that normally prevail. Custom smelters had access to all of the scrap that they could conveniently take care of, and brass ingot makers announced a reduction in prices of most grades of brass and bronze ingot.

A contributing factor to the uncertainty that hung over the copper market was the difficulty encountered in appraising the extent to which both foreign and domestic consumers would be forced to compete for the free supply of foreign copper. If some of the high estimates on consumption of copper in the United States made earlier in the year were to turn out to have been correct, the world situation might have favored sellers for some time to come. However, authorities lately have been inclined to lower their estimates on our actual copper needs and it appears highly probable that consumption will drop to around 110,000 tons a month or even less this summer. If the lower estimates prove correct, the supply situation should ease.

Unsettlement in the foreign division of the market occurred before May ended, when business was booked abroad at prices ranging from 22.375c. to 23c., f.a.s. New York equivalent. The mixed price situation in the domestic market brought on selling pressure. The scarcity of dollar exchange was mentioned as a contributing factor in limiting foreign buying.

The statistics of the domestic copper industry were revised in April to include production and deliveries regardless of the origin of the metal. Suspension of the import duty caused Copper Institute to make this change. Production of refined copper in the United States under the revised system of presenting the figures totaled 107,270 tons in April. Deliveries to consumers in the same month came to 120,311 tons, against 123,590 tons in the preceding month. Of the total quantity delivered, the Office of Metals Reserve supplied 23,089 tons.

Copper consumption in the United States in April, based on figures compiled for the fabricating section of the industry, totaled 121,391 tons, which compares with 117,981 tons in March. During the first four months of 1947, consumption of copper averaged 124,317 tons a month.

Lead continued to move in about the same volume as in the first four months of the year and the price situation was about unchanged. Most producers regarded the undertone as firm, but admitted that unsettlement in other sections of the market for non-ferrous metals could exert some influence on the trade. Late in May,

United States Copper Statistics

With the suspension of the import tariff, duty-free copper has passed out of existence and the statistical summary that follows, beginning with April, reflects this change, Copper Institute reports. The monthly report has been revised to include United States figures on crude production (primary and secondary), refined production, deliveries to customers, and stocks regardless of the origin of the copper.

	Production				
	Crude Primary	Crude Secondary	Refined	Deliveries	Stocks, Refined
1941	985,288	31,708	1,065,667	(a)1,545,848	75,564
1942	1,098,007	54,337	1,135,708	1,635,236	65,309
1943	1,111,022	83,677	1,206,871	1,643,677	52,121
1944	995,938	60,242	1,098,788	1,636,295	66,780
1945	792,126	49,541	843,113	1,517,842	76,512
1946	618,757	32,503	604,071	(b)1,261,830	80,832
1947:					
January ..	71,255	7,001	80,144	143,692	76,680
February .	69,012	5,462	77,591	117,734	74,645
March ...	75,378	8,978	88,131	123,590	69,727
April	75,687	13,130	107,270	(c)120,311	87,139

(a) Includes 307 tons exported. (b) Includes 909 tons exported. (c) Includes 222 tons exported.
Note: Beginning April, 1947, stocks at beginning of period plus production minus deliveries does not equal stocks at end of period, owing to the inclusion of foreign copper.

MARKETS—Trends and Prices

the practice of paying a premium for certain grades of lead scrap was virtually abandoned by consumers, indicating that higher prices for primary metal are no longer a probability.

Production of refined lead by primary producers during April amounted to 53,424 tons, against 51,239 tons in March. Production in April was the highest monthly total since March 1944. Domestic shipments of refined lead in April amounted to 50,568 tons. In addition, consumers obtained 8,230 tons of refined lead from the Office of Metals Reserve. Allocation of lead by the Government may dry up completely in the next two months, and as domestic production is expected to fall off in the summer period, increased supplies are not expected in July and August. Providing that the volume of business does not decline, the supply outlook remains tight.

Zinc producers were torn between conflicting forces. Demands have been made in various sections of the country for higher wages. Foreign business, which supported the market in the first four or five months of the current year, has declined in volume and unsettled prices obtained outside of the United States. World production is increasing. The domestic quotation for Prime Western continued at 10½c., East St. Louis, with the market steady. Early in the month Prime Western sold for export at 10⅝c., f.a.s. Gulf Ports, but later it was available at 10¼c.

Silver declined 3c. an ounce. The market experienced a brief spell of encouragement when it was reported here that an Indian firm was interested in obtaining 10,000,000 oz. of silver. Later it was stated that such business could not be booked because of control of both exchange and imports by the Bank of India. Consumers purchased the metal on a modest scale, which was reflected in increased offerings at lower prices.

Quicksilver was inactive, with domestic operators unable to judge conditions because of the threat of sudden price action by the European group. Spot metal declined $1 per flask during the month, settling at $84. On forward business covering round lots quotations were wholly nominal.

Tungsten was higher on rather limited offerings from foreign sources.

Major Metals

U. S. DAILY AND AVERAGE PRICES

1947 May	Electrolytic Copper: Domestic (a) Refinery	Electrolytic Copper: Export (b) Refinery	Straits Tin: New York	Lead: New York	Lead: St. Louis	Zinc: East St. Louis
1	21.225	23.675	80.000	15.000	14.800	10.500
2	21.225	23.675	80.000	15.000	14.800	10.500
3	21.225	23.675	80.000	15.000	14.800	10.500
5	21.225	23.675	80.000	15.000	14.800	10.500
6	22.525	23.700	80.000	15.000	14.800	10.500
7	22.865	23.675	80.000	15.000	14.800	10.500
8	22.725	23.675	80.000	15.000	14.800	10.500
9	23.300	23.675	80.000	15.000	14.800	10.500
10	21.225	23.675	80.000	15.000	14.800	10.500
12	22.475	23.675	80.000	15.000	14.800	10.500
13	22.900	23.675	80.000	15.000	14.800	10.500
14	22.450	23.675	80.000	15.000	14.800	10.500
15	22.225	23.675	80.000	15.000	14.800	10.500
16	22.325	23.675	80.000	15.000	14.800	10.500
17	21.225	23.675	80.000	15.000	14.800	10.500
19	22.625	23.675	80.000	15.000	14.800	10.500
20	22.525	23.675	80.000	15.000	14.800	10.500
21	21.900	23.675	80.000	15.000	14.800	10.500
22	22.425	23.675	80.000	15.000	14.800	10.500
23	22.325	23.675	80.000	15.000	14.800	10.500
24	21.225	23.675	80.000	15.000	14.800	10.500
26	22.300	23.675	80.000	15.000	14.800	10.500
27	22.350	23.675	80.000	15.000	14.800	10.500
28	22.000	23.675	80.000	15.000	14.800	10.500
29	21.800	22.850	80.000	15.000	14.800	10.500
30	Holiday	22.950	Holiday	Holiday	Holiday	Holiday
31	No Market	22.925	80.000	15.000	14.800	10.500
AVERAGES FOR MONTH						
May	22.105	23.591	80.000	15.000	14.800	10.500
AVERAGES FOR WEEK						
May						
7	21.715	23.679	80.000	15.000	14.800	10.500
14	22.513	23.675	80.000	15.000	14.800	10.500
21	22.138	23.675	80.000	15.000	14.800	10.500
28	22.104	23.675	80.000	15.000	14.800	10.500
CALENDAR WEEK AVERAGES						
May						
3	21.225	23.675	80.000	15.000	14.800	10.500
10	22.311	23.679	80.000	15.000	14.800	10.500
17	22.267	23.675	80.000	15.000	14.800	10.500
24	22.171	23.675	80.000	15.000	14.800	10.500
31	22.113	23.292	80.000	15.000	14.800	10.500

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. **All prices are in cents per pound.**

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.275c. per pound, the average differential for freight and delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month; the premium on Special High Grade in most instances is 1¼c.

Quotations for lead are for common lead.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

1947 May	Sterling Exchange "Checks"	Silver (c) New York	Silver: London	Gold: London	Gold (d) United States
1	402.500	73.750	44¾d.	172s. 3d.	$35.00
2	402.500	73.750	44¾d.	172s. 3d.	35.00
3	(c)	(c)	(c)	(c)	35.00
5	402.500	73.750	44¾d.	172s. 3d.	35.00
6	402.500	73.750	44¾d.	172s. 3d.	35.00
7	402.500	71.750	44¾d.	172s. 3d.	35.00
8	402.500	72.750	44d.	172s. 3d.	35.00
9	402.500	72.750	44¼d.	172s. 3d.	35.00
10	(c)	(c)	(c)	(c)	35.00
12	402.500	72.750	44¼d.	172s. 3d.	35.00
13	402.500	72.750	44¼d.	172s. 3d.	35.00
14	402.500	72.750	44¼d.	172s. 3d.	35.00
15	402.500	72.750	44¼d.	172s. 3d.	35.00
16	402.500	72.750	44¼d.	172s. 3d.	35.00
17	(c)	(c)	(c)	(c)	35.00
19	402.500	72.750	44¼d.	172s. 3d.	35.00
20	402.500	72.750	44¼d.	172s. 3d.	35.00
21	402.500	72.750	44¼d.	172s. 3d.	35.00
22	402.500	72.750	44d.	172s. 3d.	35.00
23	402.500	72.750	44d.	172s. 3d.	35.00
24	(c)	(c)	(c)	(c)	35.00
26	402.500	70.750	Holiday	Holiday	35.00
27	402.500	70.750	43½d.	172s. 3d.	35.00
28	402.500	70.750	43½d.	172s. 3d.	35.00
29	402.500	70.750	43d.	172s. 3d.	35.00
30	Holiday	Holiday	43d.	172s. 3d.	Holiday
31	(c)	(c)	(c)	(c)	35.00
AVERAGES FOR MONTH					
May	402.500	72.512	44.143	—	35.00
AVERAGES FOR WEEK					
May					
7	402.500	73.350	—	—	—
14	402.500	72.750	—	—	—
21	402.500	72.750	—	—	—
28	402.500	71.550	—	—	—

Calendar week averages, New York Silver: May 3rd, 74.175; 10th, 72.950; 17th, 72.750; 24th, 72.750; 31st, 70.750.

(c) No market (Saturday)

(c) Determined by Handy & Harman on the basis of market prices for bar silver, in cents per troy ounce .999 fine, in amounts of 50,000 oz. or more, nearby delivery, New York. Price quoted is in cents and one-eighth cent fractions, and is usually about one-quarter cent below the market to allow for delivery, carrying, and marketing. In addition to foreign silver, the quotation also applies to domestic and Treasury silver if such silver enters into the market. The Treasury's purchase price of newly mined domestic silver **90.5c. per troy ounce 1000 fine, effective July 1,** 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS—Trends and Prices

Miscellaneous Metals

(Monthly Averages)

Average prices of miscellaneous metals for April and May:

	April	May
Quicksilver, N. Y. flask	85.769	84.462
Antimony (a)	35.940	35.940
Antimony, bulk, Laredo	33.000	33.000
Antimony, in cases, Laredo	33.500	33.500
Antimony, Chinese (b)	.....	.....
Platinum, oz. troy	60.885	59.269
Cadmium (c)	175.000	175.000
Cadmium (d)	177.500	177.500
Cadmium (e)	180.000	180.000
Aluminum ingot	15.000	15.000
Magnesium	20.500	20.500

(a) New York, packed in cases, in lots of 5 tons or more but less than a carload. (b) Nominal. (c) Producer's price for commercial sticks. (d) Average producers' and platers' quotations. (e) Special shapes sold to platers.

E. & M. J. Weighted Index of Non-Ferrous Metal Prices

100 is composite for 1922-3-4. (Copper, Lead, Zinc, Tin, Silver, Nickel, Aluminum)

1937	90.86	1942	86.80
1938	73.67	1943	88.74
1939	77.71	1944	88.74
1940	79.22	1945	90.86
1941	83.49	1946	110.057

	1945	1946	1947
January	88.74	96.42	140.88
February	88.74	96.42	140.42
March	88.74	96.42	150.71
April	88.74	96.42	153.14
May	88.74	96.42	154.03
June	88.74	107.16	.....
July	88.74	117.11	.....
August	88.74	113.32	.....
September	91.16	113.32	.....
October	96.40	114.25	.....
November	96.42	131.23	.....
December	96.42	142.19	.....

Official London Prices

Since Dec. 18, 1939, the British Ministry of Supply has named maximum delivered prices for the major non-ferrous metals. Prevailing delivered prices for consumers in the United Kingdom follow:

	Per Long Ton £	s.	d.
COPPER:			
Electrolytic, high conductivity	137	0	0
Fire refined, high conductivity	137	0	0
Fire refined, high grade	136	10	0
Fire refined, min. 99.2 percent	135	10	0
Fire refined, min. 99.7	136	0	0
Hot rolled black wire rods	132	0	0
LEAD:			
Soft, foreign, duty paid	90	0	0
Soft, Empire	90	0	0
English refined	91	10	0
ZINC:			
Foreign (G.o.b.), duty paid	70	0	0
Domestic (G.o.b.)	70	0	0
Prime Western and debased	70	0	0
Refined and electrolytic	70	15	0
Minimum 99.99 percent	72	5	0
TIN:			
Ingot, 99 percent	437	0	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

MISCELLANEOUS METALS

(May 31, 1947)

Aluminum, ingot, 99 plus percent, lb.	15c.
Antimony, spot, lb., 5 tons and up but less than carload, in cases	35.940
Bismuth, ton lots, lb.	$2.00
Cadmium, commercial sticks, lb.	$1.75
Calcium, lb. ton lots, 97 @ 98 percent, cast	$1.85
Chromium, 97 percent grade, lb.	89c.
Cobalt, 97 to 99 percent, per lb.	$1.50
Indium, troy oz.	$2.25
Nickel, electrolytic cathodes, lb.	35c.
Magnesium, 99.8 percent, carloads, lb.	20½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$58.00
Quicksilver, flask of 76 lb., 25 flasks or more	$84.00
Selenium, 99.5 percent, lb.	$1.75
Silicon, minimum 97 percent, spot, carloads, lb.	14.75c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$20.00
Titanium, 96 to 98 percent, lb.	$5.00

METALLIC ORES

Beryllium Ore, 8 to 12% BeO, f.o.b. mine, per unit	$14.00@$16.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 48% Cr_2O_3, 2.8 to 1 ratio (Prices nominal)	$37.00@$38.00
48% Cr_2O_3, 3 to 1 ratio	$39.00@$40.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$5.95
Mesabi bessemer	$5.70
Old Range non-bessemer	$5.80
Mesabi, non-bessemer	$5.55
Lead (Galena) 80 percent, Joplin, Mo., ton	$195.65
Manganese Ore—Per long ton unit of Mn, basis 48 percent manganese, subject to premiums and penalties, f.o.b. cars Atlantic and Gulf ports, duty paid, 67@69c.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Foreign, 60 percent, duty paid	$29.00@$31.00
Domestic, scheelite, 60 percent and upward	$28.00@$30.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27½c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$64.00

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl., carload lots	6c.
Cobalt Oxide, 70 to 71 percent, lb.	$1.06
Copper Sulphate, 100 lb.	$7.60

ALLOYS

Beryllium Copper, 2.5 to 3 percent Be, per lb. of contained Be	$14.75
Ferrochrome, 65 to 70 percent, per lb. of Cr contained	15.60c.
Ferromanganese, 78 to 82 percent, gross ton	$135.00
Ferromolybdenum, 55 to 65 percent Mo, lb. of Mo contained	95c.
Ferrosilicon, 50 percent, per lb. of contained Si	7.45c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$2.25
Ferrovanadium, per lb. of V delivered	$2.70@$2.90
Silicomanganese, 1 percent C, per lb., contracts	6.45c.

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U.S funds), ton:	
Crude No. 1	$650@$758
Crude No. 2	$165@$385
Spinning fibers	$124@$233
Paper stock	$44@$49.50
Shorts	$14.50@$26.50
Vermont, f.o.b. Hyde Park:	
Shingle stock	$62.50@$65.00
Paper stock	$44.00@$53.00
Shorts	$14.50@$28.50
Floats	$19.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$11.50@$12.00
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$8.50@$9.50
Bauxite, long ton:	
Domestic, crude, 50 to 52 percent (not dried)	$4.00@$5.00
Domestic, chemical, 55 to 58 percent	$7.50@$8.50
Domestic, abrasive, 80 to 84 percent	$16.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$15.00
Feldspar, bulk ton:	
Potash feldspar, 200 mesh	$17.00
Glass spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 70 percent, all rail movement, ton	$33.00
Acid 98 and 1 percent, bulk, ton	$37.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, f.o.b. Washington	$22.00
Mica: Domestic producers quote on punch and sheet as follows: Punch, 22c. per pound; 1½x2 inch, $1.10; 2x2 inch, $1.60; 2x3 inch, $2.10; 3x3 inch, $2.75; 3x4 inch, $3.50; 3x5 inch, $4; 4x6 inch, $5. Wet ground, very fine, $90 per ton. Special grades command premium. Bulk sales dry ground, $32.50 per ton. Scrap, $28 per ton and up.	
Ocher, Georgia, ton	$24.00
Pyrites, Spanish, per long ton unit of S, c i f, Atlantic ports	12c. nom.
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
Vermont, extra white, 200 mesh	$9.50@$10.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic	$33.00
Steel, base price, Pittsburgh Billets, gross ton	$42.00
Structural shapes, 100 lb.	$2.65

WASHINGTON REFLECTIONS

McGRAW-HILL WASHINGTON NEWS BUREAU

Premium Price Plan Costs Disclosed by Administrator

According to C. O. Mittendorf, director of the Premium Price Plan in OWMR, subsidized copper, lead, and zinc mines have recently been receiving average premiums of 3.14¢ per pound of copper, 2.8¢ for zinc, and 0.15¢ for lead.

Testifying on May 22 before Senator Malone's subcommittee investigating natural resources, Mr. Mittendorf pointed out that higher prices have caused substantial reductions in premiums. Payments in the 12 months from July 1, 1945, to June 30, 1946, of $81,890,730, were nearly double those for the 9 months of the period July 1, 1946, to April 1, 1947, of $42,456,508. On a monthly basis, this represents a 31% decline.

Subsidized mines in March accounted for 5.4% of national mine output of copper, 52% of the lead, and 73% of the zinc.

OTC has recommended 76 exploration project premiums with a total commitment on the part of the Government of approximately $5,000,000, Mr. Mittendorf said.

Copper premiums in 1946 totaled $22,094,532, those for lead reached $16,784,341, and for zinc amounted to $37,442,297.

Tonnage of premium metal in 1946 follows: Copper, 203,688; lead, 225,662; and zinc, 378,139.

Total price per pound of premium metals in 1946 was: copper, 19.237¢; lead: East-West, 10.091¢; Tri-State, 11.410¢; zinc: East-West, 12.282¢; Tri-State, 14.572¢.

Premium payments made from February 1942 through March 1947 totaled $335,913,371.

USBM Makes Drastic Cuts To Meet Slash in Budget

The field staff of the Bureau of Mines has been alerted to prepare for closing of four large and eight small pilot plants, abandoning or sharply curtailing exploration and research on fissionable and strategic minerals, and discontinuing numerous services to industry.

These moves are necessitated by Congressional cuts in the Bureau's budget. The House slashed the requested appropriation from $16,834,000 to $10,938,875.

There is little hope that the Senate, as in past years, will restore the bulk of the House cuts. The cries of Westerners have had little effect on Republicans; also, the noise has been loudest for restoration of reclamation funds, rather than for Bureau or Survey appropriations.

Dr. R. R. Sayers, director of the Bureau, has informed Secretary J. A. Krug that major installations scheduled for closing July 1 are the electrolytic manganese pilot operation at Boulder City, Nev., the bauxite beneficiation mill at Bauxite, Ark., the rotary kiln sponge-iron pilot plant and laboratory at Laramie, Wyo., and the lignite gasification pilot operation at Grand Forks, N. D.

Smaller operations to be abandoned include the tunnel kiln sponge-iron and tungsten metallurgy plants at Raleigh, N. C.; zinc dithionate, vanadium, and antimony plants at Salt Lake City, Utah; electrothermic magnesium plant at Pullman, Wash.; pyrometallurgy plant at Boulder City, Nev.; and the alumina works at Rolla, Mo.

In addition to the closing of plants, construction will be halted on a zirconium pilot plant at Albany, Ore.; studies on iron ore beneficiation at Tuscaloosa, Ala., and on steel at Raleigh, N. C., will be abandoned; and metallurgical research will be curtailed by 50% or more in remaining plants.

Senate Opens Investigation Of Natural Resources Status

A special investigation to determine how the natural resources of the United States can best be developed and utilized to promote national defense and the maintenance of a high standard of living was started May 15 by Senator George W. Malone's special national resources economic subcommittee of the Senate Committee on Public Lands.

Senator Malone (R., Nev.) announced that the investigation would embrace an analysis of all factors affecting the production, distribution, and marketing of agricultural and mineral resources of this country. This will include discussions on tariffs, quotas, subsidies, imperial preference systems, and manipulation of exchange rates.

Virtual textbook for the series of hearings on minerals is a 325-page report on the "Mineral Position of the United States," prepared by the Interior Department (p.80). The report, which required five years to prepare, is a review of the country's 39 principal mineral and metal commodities.

The report, not yet available to the public, is expected to be printed by Senator Malone's subcommittee in the near future.

Governmental agencies expected to be called in to discuss American self-sufficiency in minerals include Army and Navy Munitions Board, State, War and Commerce Departments, Tariff Commission, and the Justice Department. The Interior Department was the first to be heard.

Leaders in the mining, fuels, and fabricating industries will also be invited to testify. Witnesses who wish to testify are required to file in advance written statements of their proposed testimony and limit their oral presentations to brief summaries of their argument, Malone said.

May Stop Publication Of German Technology

The Office of Technical Services of the Department of Commerce was given the economic axe last month when the Department's budget was considered in the House of Representatives.

To the mining and metallurgical industry this will mean that the OTS program of evaluation, translation, and publication of some 400,000 German technical documents, many of which contain detailed outlines of new technological skills, will be dropped.

OTS was vulnerable because its activities had never been authorized by specific legislation. A point of order from the floor eliminated any appropriation for the agency. Although legislation has been introduced to bolster the office's legal status, it appeared highly doubtful that the measure would pass.

New Association Formed To Protect Marginal Mines

The formation of a national mineral policy and the encouragement of conservation and development of strategic and critical mineral resources is the aim of the recently formed National Minerals Conservation Council. Dr. Edwin R. Shorey, professor of mining engineering at the University of Wisconsin, will be its president.

Dr. Shorey said that "this program recognizes the incontrovertible fact that true conservation means unabated exploration of known reserves by experienced mining men and technicians as expressed in the timeless axiom 'ore begets ore' and does not mean leaving known ore reserves in the ground on the theory that ores can be mined at any convenient time. They cannot."

Endorsement of the Premium Price Plan is implied in the statement issued by Dr. Shorey.

The council will not conflict with the activities of any local, state, or national mining organization but will supplement such activities. Its membership will be composed of mining associations only and its directorship will include a delegate from each association, the council president said.

Present members of the council include the American Manganese Association, Arizona Small Mine Operators Association, Colorado Mining Association, Mining Association of the Southwest, New Mexico Miners and Prospectors Association, Oregon Mining Association, Tri-State Zinc and Lead Ore Producers Association, Western Montana Mine Owners and Operators Association, and the Wisconsin, Illinois, and Iowa Zinc and Lead Producers Association. Invitations have been extended to other organizations interested in the program of the council.

Pollution Compromise Is Offered by Fleming

A new and fairly original approach to the stream-pollution problem facing the nation, and one which might well provide the basis for agreement between the two houses of Congress, has been advanced by Maj. Gen. Philip B. Fleming, head of the Federal Works Agency.

Water pollution has become such an important national problem that the 80th Congress is almost certain to pass some legislation encouraging or compelling abatement. The two measures before the House Public Works Committee are the Mundt (H.R.123) and Spence (H.R.315) bills. The Senate Public Works Committee is considering the Taft-Barkley bill (S-418), a companion to Congressman Spence's measure, which is less severe on industry than the Mundt bill.

Fleming's ideas, which probably will be used to amend the Taft-Barkley bill, would take some of the sting out of the Senate bill. Under his proposal, there would be no Federal authority to bring a state or state agency into court, and the provision for loans to private industry on the theory that abatement of water pollution is primarily a public responsibility would be dropped.

Engineering and construction phases of the law would be transferred to FWA. Fleming's point was that these functions are already being performed by public works and that there was no need to set up a parallel agency to exercise the same functions in the Federal Security Administration. Programming and surveys, and all health aspects of the problem, would remain a duty of the Public Health Service. The Surgeon-General would have, in effect, a veto power over FWA expenditures for plans or actual construction that did not fit into the programming and planning of the Federal Public Health Service.

Other important points of the Fleming proposal include authorization of funds for state health departments to do most of the survey work and advancement from Federal funds for plan preparation, and a proposal for Federal loans to states for construction projects, instead of outright grants.

New Name for OTC; Tin Control to Be Continued

Washington alphabeteers have turned out another, and probably the last, set of letters denoting Governmental control over civilian production. This latest is the OMD, Office of Materials Distribution, the end product of NDAC, OPM, SPAB, WPB, CPA, and OTC.

Horace B. McCoy, on leave from his regular position as director of the Office of Domestic Commerce of the Department of Commerce, is the head of the new office. It is his job to scrap whatever is still left of the wartime controls over industry. He directs four divisions engaged in carrying on the administration of the controls in rubber, chemicals, metals, and cordage. Tin and antimony make up the metals still under control by allocation.

Whatever happens to control of other commodities, tin will probably remain under control for some time. Government experts who attended the world-wide conference on allocation and production of the metal at Brussels on April 19 see a 15-month deficiency before the supply picks up to a point where controls might be relaxed somewhat.

Russell Bill Only Mining Measure to Be Put to Vote

Only one of five bills of special interest to the mining industry introduced during the present session of Congress is likely to see action (*E.&M.J.*, Feb., p.118).

The National Minerals Development and Conservation bill (H.R.2455), which would continue the Premium Price Plan for copper, lead, and zinc on an $80,000,000 a year subsidy for five years, is the only measure which has any chance of passage. The bill was on the docket for House consideration at the end of last month after three weeks of hearings by the Rules Committee. Republican policy on cutting down spending was one deterrent to final action. Opposition within the mining industry was also hurting the measure's chances.

Senate committee hearings on the RFC act, and the lateness of the session, are responsible for inaction on other bills.

Substitute legislation for the contract termination proposals tabled in the last session is another measure which will gather dust this session. This legislation (H.R.1285) would authorize payment of compensation for furnishing or arranging to furnish, at a loss, strategic or critical minerals and metals for the prosecution of the war. Republican objections to "money bills" helped put this measure on the shelf.

S-32, Senator McCarran's amendment of the act authorizing the President to make withdrawals of public lands, apparently will die in committee. Nothing has been heard of it since it was referred to committee early in the session. The amendment would limit the time a temporary withdrawal could stay in effect, would direct the Secretary of Interior to report all outstanding withdrawals at the beginning of each session of Congress, and would necessitate positive Congressional approval on all temporary withdrawals of public lands.

Labor Reform Measure Put Into Final Form

After the Senate passed a milder labor reform bill than the House (*E.&M.J.*, May, p. 84), conferees appointed to compromise the differences wrote a new bill based principally on the Senate measure.

This (Taft-Hartley) bill not only offers the first change in the 12-year-old National Labor Relations (Wagner) Act, but actually rewrites it completely from beginning to end—and adds to it. In general, it would impose obligations on management and labor unions alike, give individual union members more freedom from union control, and take steps against such labor abuses as jurisdictional strikes and secondary boycotts.

Other major provisions of the bill would: permit injunctions, for 80 days, against strikes which imperil national health or safety; bar employer contributions to union welfare funds unless there is joint administration and the purposes are set forth in writing; ban the closed shop, but allow the union shop where a majority of the employees favor it; deny supervisors collective bargaining rights; and establish an independent federal mediation service.

Craft workers could maintain separate identity. The bill would recognize the special interests of professional workers, as distinct from production workers, by permitting them to bargain as a separate group if they so desire. A union of plant guards would not be certified if its membership includes non-guards or is affiliated with an organization which does, such as the C.I.O. or A.F.L.

The bill was approved by both houses of Congress early in June and sent to the President. Despite predictions of a veto by many political wiseacres, it was recognized as a difficult bill to veto and likely to be passed over a veto, if necessary.

NEWS OF THE INDUSTRY

MMSW Affairs Confused As Insurgents Secede

Recent events leave uncharted the future course of the Progressive Metalworkers Council, formerly the Provisional Metalworkers Council, whose 24,000 members have seceded from the International Union of Mine, Mill & Smelter Workers, CIO, over the issue of communist domination.

The group obtained charters from another CIO union, the Industrial Union of Marine & Shipbuilding Workers of America, and won three National Labor Relations Board elections from MMSW. But the CIO executive board has recommended a four-point procedure for settling the factional dispute which leaves the secessionists the alternative of returning to MMSW or dissociating themselves from the CIO.

Because the CIO executive board vote was not unanimous, but 27 to 8, its recommendation is not binding, thus further confusing the outlook. The board recommended that:

1. John Driscoll, leader of PMC, be suspended as paid secretary of the Connecticut CIO council.

2. IUMSWA rescind all charters issued to PMC and refrain from interfering in MMSW affairs.

3. Maurice Travis, who succeeded Reid Robinson as MMSW president in a sudden maneuver as the CIO board was about to tackle the situation, resign or be removed from office.

4. MMSW affairs be administered by a CIO-appointed committee until unity is restored and new officers are elected under the supervision of the national CIO.

John Green, president of IUMSWA, indicated he would ask his executive board to accept the committee report and rescind the charters issued to the secessionists. Robinson said MMSW would not accept the report, which would mean Travis' resignation and new elections. The situation may simmer until the CIO convention in October, to which the dispute was referred because of lack of agreement.

Results of seven NLRB elections conducted on May 21 and 22 underscored the sharpness of the differences in MMSW. Three were won by MMSW and a like number by the secessionists, who were identified as IUMSWA on the ballots. The seventh was inconclusive. In total votes, MMSW polled 5,549 and IUMSWA 5,137. There were 510 votes for neither group.

Meanwhile the threatened secession of 6,000 members of district 2 of the IUMMSW in Utah and Nevada awaits the outcome of a report of a special committee appointed by Philip Murray, CIO president, in an attempt to compose internal differences. A resolution to defer action on withdrawal was adopted after bitter debate at a recent district conference in Salt Lake City. Prior to the opening of this meeting, J. Frank Marble, district head, who is said to have openly urged secession, resigned, charging that communism "has an almost unrestricted control over our international union."

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Uranium Ore Prices Set by Vanadium Corporation

The Vanadium Corporation of America has established the following schedule of payments, effective April 12, 1947, for U_3O_8 contained in ore delivered to the corporation's stockpile at Naturita, Colo:

U_3O_8 Contained	Price per Pound, U_3O_8 Contained
Under 0.20%	No payment
From 0.20% through 0.30%	35c.
From 0.31% through 0.40%	40c.
From 0.41% through 0.50%	50c.
From 0.51% through 1.00%	60c.
From 1.01% through 1.25%	70c.
From 1.26% through 1.50%	80c.
From 1.51% through 1.75%	90c.
From 1.76% through 2.00%	$1.00
From 2.01% and over	$1.10

Ores that may contain less than 0.20% U_3O_8 may be purchased for the V_2O_5 content, if 2.00% or more. Any ore containing more than 6.00% lime ($CaCO_3$) may be rejected. The above prices do not apply to ore received from any properties owned, leased by or to Vanadium Corporation of America.

Payments will be based upon composite analysis of shipments, if more than one, between cut-off settlement dates, which are the 1st and 15th of the month, with payment to be made on the 10th and 25th of each month. In the event of disagreement on assays the seller, at his own expense, may select an umpire acceptable to Vanadium Corporation of America, whose findings will be conclusive and binding upon the seller of the ore and Vanadium Corporation.

International Nickel To Extend Fellowship Awards

An extension of the INCO fellowship awards in Canada, Great Britain and the United States was announced by Robert C. Stanley, chairman and president, at the annual meeting of the International Nickel Co. of Canada, Ltd., in Toronto April 30. The fellowships are part of a broadened program of cooperation recently extended by International Nickel to universities and colleges in the field of technical education.

In announcing the fellowships for post-graduate study, Mr. Stanley said: "For the past six years post-graduate scholarships have been given by this company to students in three Canadian universities: Queens, Toronto and McGill. A further program of cooperation has now been established with educational institutions in Canada, Great Britain and the United States which offer courses in mining, metallurgy and engineering. The objects are to assist in the better training of scientists; to extend their knowledge of nickel, copper, platinum and the platinum metals; and to encourage applications of the results of research to metallurgical industries."

In Canada, three scholarships are awarded annually by a committee of which R. L. Beattie, vice president in charge of Canadian operations, is chairman. Exhibits and technical literature will be given to libraries, faculties and students in 20 educational institutions.

In the United States six two-year fellowships will be awarded biannually over a period of twelve years. Awards will be made by a committee of which Dr. Paul D. Merica, of New York, vice president of the company, is chairman. "During the same period," Mr. Stanley added, "exhibits and technical publicity will be distributed to the libraries, to 1,200 teachers and to 25,000 students in more than 50 educational institutions.

The United States fellowships provide an annual stipend and tuition for study in the fields of nickel, copper

and the platinum metals. They will be awarded to Massachusetts Institute of Technology, Carnegie Institute of Technology, Yale University, University of Michigan, University of Illinois and Johns Hopkins University.

A British fund is also set up.

Zinc Institute Speakers Foresee Good Markets

Meeting in St. Louis on April 28 and 29, after a lapse of three years, the annual gathering of the American Zinc Institute was constructive and well attended. More than 300 registered.

There were three half-day sessions. Salient feature of the first session was a discussion of "Zinc Metal Supply—Domestic and Foreign," by T. H. Miller and R. H. Mote, of the U. S. Bureau of Mines. They forecast a world (ex USSR) production of 1,636,000 tons in 1947 and 1,830,000 tons in 1948. They predicted that domestic production would be 800,000 tons in 1947, that future normal domestic requirements would probably exceed 700,000 tons per year, and that the United States would have a net import requirement of 80-90,000 tons per year. They pointed out that the new Kipushi mine in the Congo would probably account for the bulk of Belgian requirements. (This will probably mean that more Mexican concentrates will move to this country than in the past—Ed.)

This session also included the secretary's report and a description of the Institute's important work in promoting the use of zinc, particularly in the farm markets. T. R. Sills also spoke on "Industrial Relations—The Public in the Picket Line," pointing out that even when employees are on strike, it is important to cultivate their good will.

The second session was principally on the market outlook for zinc products. J. D. Conover, American Mining Congress secretary, gave a resumé of "Washington News." In discussing "Market Outlook for Zinc Pigments," M. L. Havey, New Jersey Zinc Co., called attention to a broadening market, limited only by available supplies. According to E. F. Lundeen, Inland Steel Co., there is a very large backlog of demand for galvanized sheets, but plastic-coatings and aluminum are furnishing noteworthy competition. D. M. Strickland, American Hot Dip Galvanizers Association, looked for good business for job galvanizers in a competitive market. David Laine, American Die Casting Institute, anticipated continued growth of the use of zinc in die casting. H. A. Schlieder, Revere Copper and Brass, Inc., saw good markets ahead for brass, the requirements for new zinc being qualified by heavy liquidations of military supplies. Discussing the outlook for rolled zinc, H. D. Carus, Matthiesen & Hegeler Zinc Co., predicted that production in 1947 would be decidedly lower than the 1946 total of 107,793 tons.

In the third session, Col. O. O. Niergarth, Army and Navy Munitions Board, spoke on "Stockpiling and Industrial Planning," pointing out that Government purchasing policy was to avoid competing with important industrial requirements. Addressing the group on "Zinc Ore Supply—Domestic and Foreign," G. C. Heikes, Mines, Inc., stated his belief that Government estimates of domestic reserves are too low and stressed the importance of progressive management and technological factors. He cited the resumé of foreign reserves in the January issue of *E. & M. J.* as an adequate picture of known reserves abroad, pointing out that their size does not warrant neglect of domestic supplies. He urged subsidies to prevent waste, maximum free enterprise, and more exploration and geological mapping.

Discussing "Subsidies—Pro and Con," Evan Just, *Engineering and Mining Journal*, gave the results of a questionnaire survey of zinc producers which indicated a divided viewpoint in all branches of the industry. He stated that most producers were pro-subsidy but that most of the large producers were against them. He said that a majority favored subsidies where necessary to prevent waste and that a majority believed that zinc smelting should have whatever tariff protection is necessary to maintain the industry.

Speaking on "Safety and Health in the Zinc Industry," J. K. Richardson, Utah Mining Association, stated that the industry has no cause for complacency over its handling of safety and health problems. He advocated that safety codes should penalize violators.

The Galvanizers Committee had several papers on the technology of galvanizing. Howard I. Young, American Zinc, Lead and Smelting Co., was reelected as president of the Institute for the coming year.

Carnotite Deposit Found On Arizona Property

The recent discovery of a large deposit of uranium-bearing ore on an Arizona copper claim is disclosed by the Arizona Department of Mineral Resources. According to an official of the department the ore was found in a deposit of carnotite in Hack's Canyon, 155 miles southwest of Fredonia, Ariz., and not far from the north rim of the Grand Canyon. Preliminary assays showed a uranium content of 1½%, and tests were under way to determine if the occurrence is in sufficient quantity to be exploited on a commercial basis. The discovery was made by G. C. Harwood, operator of the copper property.

Underground Plant Sites To Be Surveyed for Army

A survey of sites suitable for underground plant installations is to be undertaken for the Army by the engineering firm of Guy B. Panero, of New York. The purpose is to determine the feasibility of using worked-out mine stopes or other underground openings to provide space for subterranean production plants secure from air attack. It is reported that the U. S. Bureau of Mines declined an invitation by the Army to conduct such a study, on the grounds that budget cuts had left insufficient funds.

The lead-zinc mines of the Tri-State field are considered most certain to be given serious study as offering large, relatively shallow areas which would lend themselves to factory installations with ample span and headroom for the production of big units, such as bomber planes. The southeast Missouri lead mines and the lead-zinc workings in southern Illinois and Wisconsin will also come in for investigation. Most shaft mines, strip mines, quarries and coal mines are not regarded as usable. The Army Corps of Engineers has estimated "several hundred million" square feet of usable mine space, but mining men take a skeptical view of this figure.

Germany is said to have achieved surprising success in World War II in moving its production plant underground. It had 143 factories in tunnels, mines, covered quarries and under-hill excavations.

Freeport Subsidiary Uses New Grinding Process

Freeport Sulphur Co. has formed a new subsidiary, The Micronizer Co., to engage in grinding materials to extremely fine particle sizes by a patented process known as "Micronizing," Langbourne M. Williams, Jr., president, announced on May 15.

The new subsidiary has purchased the assets of International Pulverizing Corporation and affiliated companies, including American Pulverizing Corporation, Micronizer Processing Co., Inc., and Micronized Products, Inc. It will operate existing plants at Moorestown, N. J., and Charlotte, Mich., and will grind sulphur for agricultural use, organic insecticides such as DDT, inorganic pigments, pharmaceuticals, and other materials.

The "micronizing" process, it was explained, involves circulating the material to be ground in a circular chamber at very high speeds by the force of compressed air or steam. At the desired degree of fineness the particles are removed automatically by a centrifugal classifying action. It is considered to be the most efficient process known for reducing dry materials to micron sizes.

SAFE POWER

There are no haulage slow-downs with EXIDE-IRONCLAD BATTERIES on the job

Full shift availability, at sustained speeds throughout the day, is one of the many distinctive features of Exide-Ironclad Batteries. Operators of mines, quarries and tunnel projects who are now using these powerful, rugged batteries know that they fully meet every requirement of trammer, locomotive and shuttlecar power.

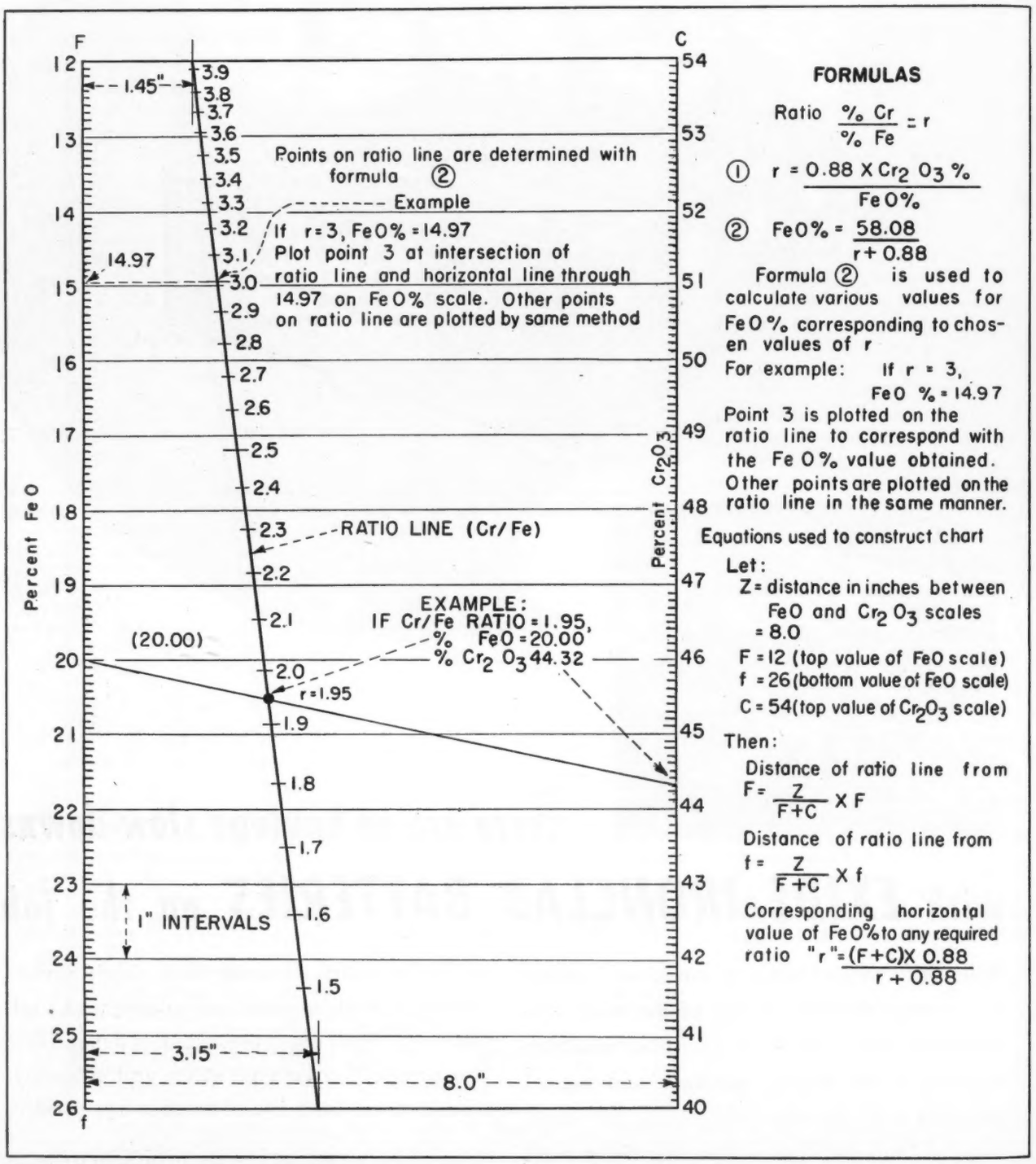
Exide-Ironclad Batteries have high power ability, a high maintained voltage and high capacity. Their use is assurance of dependable performance, maximum safety and economy, and an extra long-life of trouble-free service.

If you have a special battery problem, or wish more detailed information, write for booklet Form 1982.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

OPERATING IDEAS

Chrome-Iron Ratio Chart



FORMULAS

Ratio $\frac{\%\ Cr}{\%\ Fe} = r$

① $r = \frac{0.88 \times Cr_2O_3\ \%}{FeO\%}$

② $FeO\% = \frac{58.08}{r + 0.88}$

Formula ② is used to calculate various values for FeO% corresponding to chosen values of r

For example: If r = 3, FeO % = 14.97

Point 3 is plotted on the ratio line to correspond with the FeO% value obtained. Other points are plotted on the ratio line in the same manner.

Equations used to construct chart

Let:

Z = distance in inches between FeO and Cr_2O_3 scales = 8.0

F = 12 (top value of FeO scale)

f = 26 (bottom value of FeO scale)

C = 54 (top value of Cr_2O_3 scale)

Then:

Distance of ratio line from $F = \frac{Z}{F+C} \times F$

Distance of ratio line from $f = \frac{Z}{F+C} \times f$

Corresponding horizontal value of FeO% to any required ratio $r = \frac{(F+C) \times 0.88}{r + 0.88}$

This chrome-iron ratio chart is suggested by C. O. Wraith, Selukwe, Southern Rhodesia, Africa, for engineers working with chrome ores.

If scales for FeO% and Cr_2O_3% are constructed 8 in. apart, as shown, with stipulated values plotted thereon at 1-in. intervals, and if the ratio line is plotted as shown, the chart may be used to determine FeO% and Cr_2O_3% for various Cr/Fe values indicated on the ratio line.

The formulas upon which the chart is based, and the equations used in constructing the chart, are given above.

. . . Slash Downtime Hours with— FIRESTONE Tires and Project Service

EVERY contractor knows how quickly minutes add up in dollars of lost profit whenever any equipment "goes down" on the job. To avoid downtime due to tire failure, many contractors are using the new Firestone combination—off-the-highway tires and on-the-project service.

Firestone Project Service is a basic and simple program which pays off in greatly increased production and extra hours of tire life.

Firestone tire service engineers will analyze your operation, recommend the tires specifically built for that type of work. They will install an inspection and maintenance schedule which will cut your tire costs to the bone. And if you wish, these engineers will assume full responsibility for the successful operation of every tire on your project.

For further details, and without obligation, write Project Service Engineering, The Firestone Tire & Rubber Company, Akron, Ohio.

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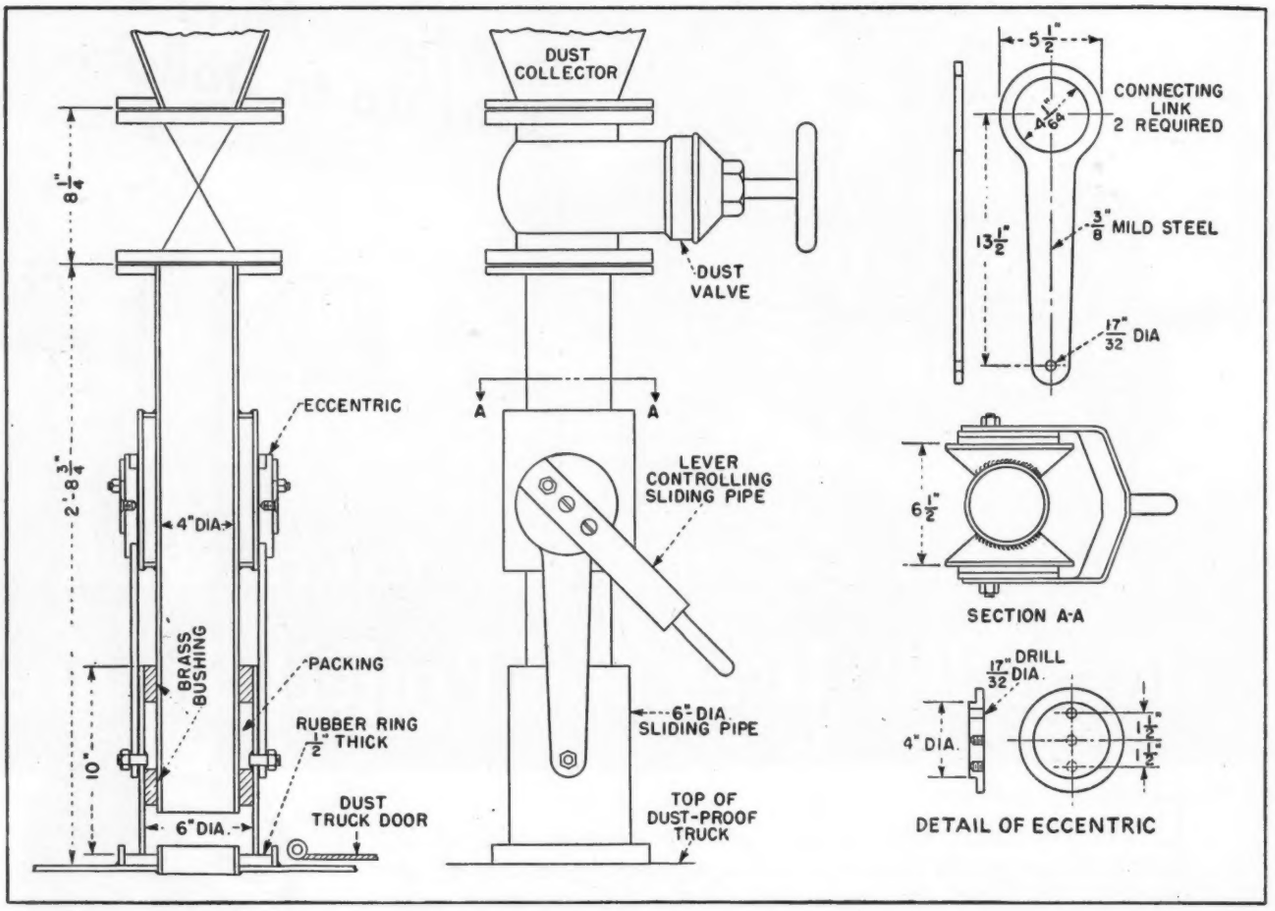
Firestone

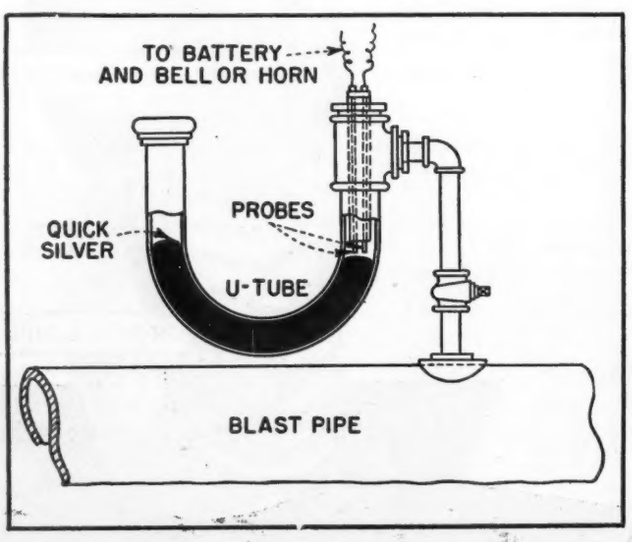
OFF - THE - HIGHWAY TIRES

Sliding Sleeve Seals Dust Discharge



F. Cunningham of Mt. Morgan, Queensland, Australia, submits this drawing of a dust-proof discharge used to transfer injurious dusts from a collector to a dust-proof truck. After the truck is spotted beneath the discharge, a lever operating through an eccentric pushes a sliding pipe down on a rubber ring. With the discharge effectively sealed, the dust valve is opened. When the truck is full, the operator closes the dust valve, raises the sliding pipe, and closes the door on top of the truck.

Alarm for Air Lines in Mills and Smelters



This inexpensive automatic alarm which indicates a pressure drop in air lines to smelter furnaces or pneumatic-type flotation machines has been used satisfactorily in mills and smelters in the United States and Mexico.

The pipe assembly is constructed of standard nipples, elbow, Tee, and bushing. It may be attached to the blast pipe by soldering it to a reinforced hole in the pipe, or mounted on a wall and connected to the pipe with a rubber hose.

A cap is set loosely over the free end of the U-tube to permit free flow of air both ways as the mercury column rises and falls with pressure changes. Two wires or probes are led into the assembly through a bushing in the Tee. The upper ends of the wires are connected to a visible or audible alarm signal.

As long as adequate pressure is maintained in the pipe line, the mercury will be forced away from the probes. If the pressure fails, however, the mercury column will rise and close the alarm circuit.

Increase your production 33%

with equivalent steel tonnage

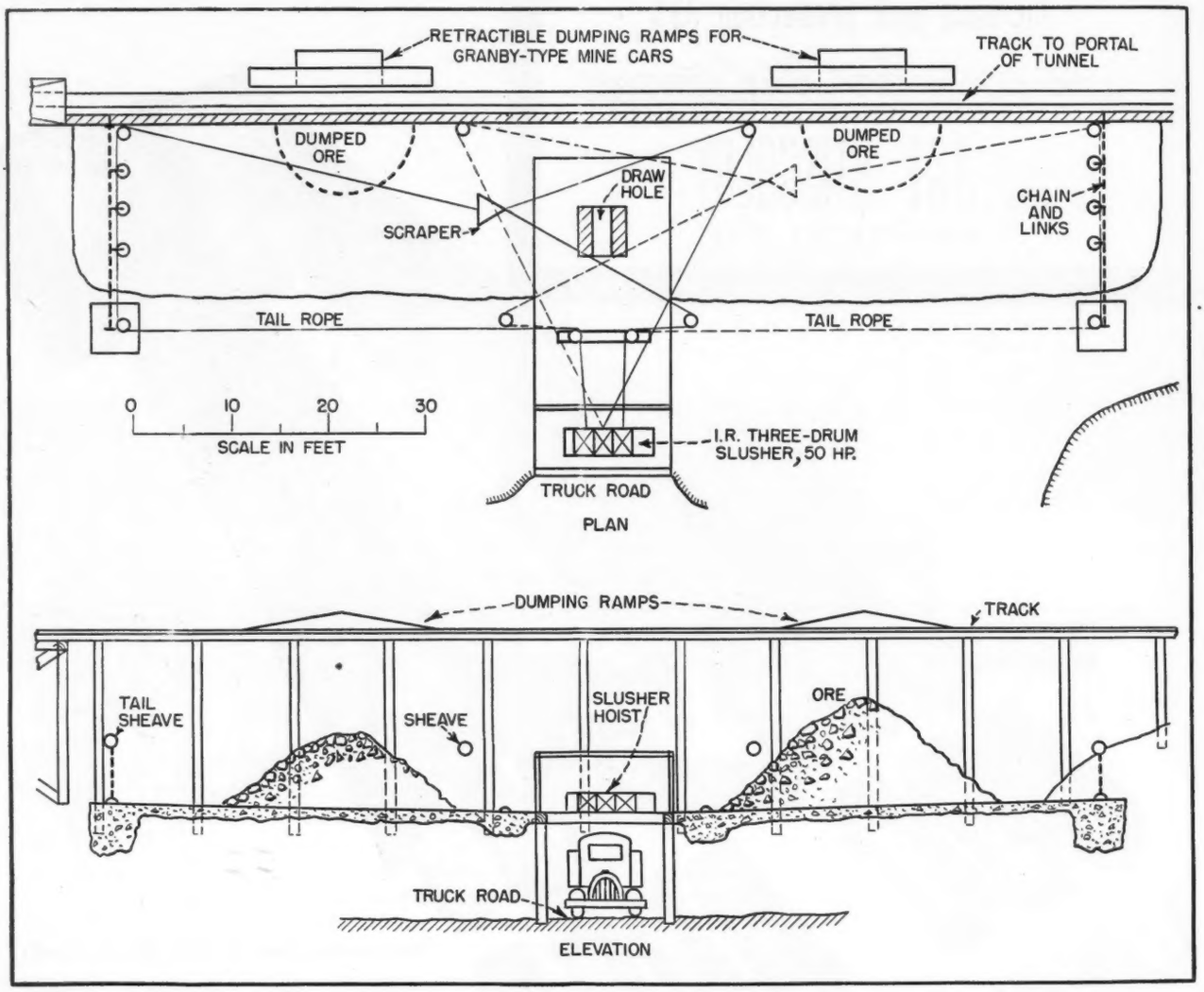
USE J&L OTISCOLOY
HIGH-TENSILE STEEL

The elimination of 25% of the dead-weight of many products is possible through use of J&L Otiscoloy High-Tensile steel instead of carbon steel. Several manufacturers have taken advantage of this saving in weight and with Otiscoloy are producing one-third more units per ton than with an equivalent tonnage of carbon steel. Write for information on how to increase your unit production with less steel.

J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH 30, PENNSYLVANIA

Scraper Pit Takes Place of Ore Bin

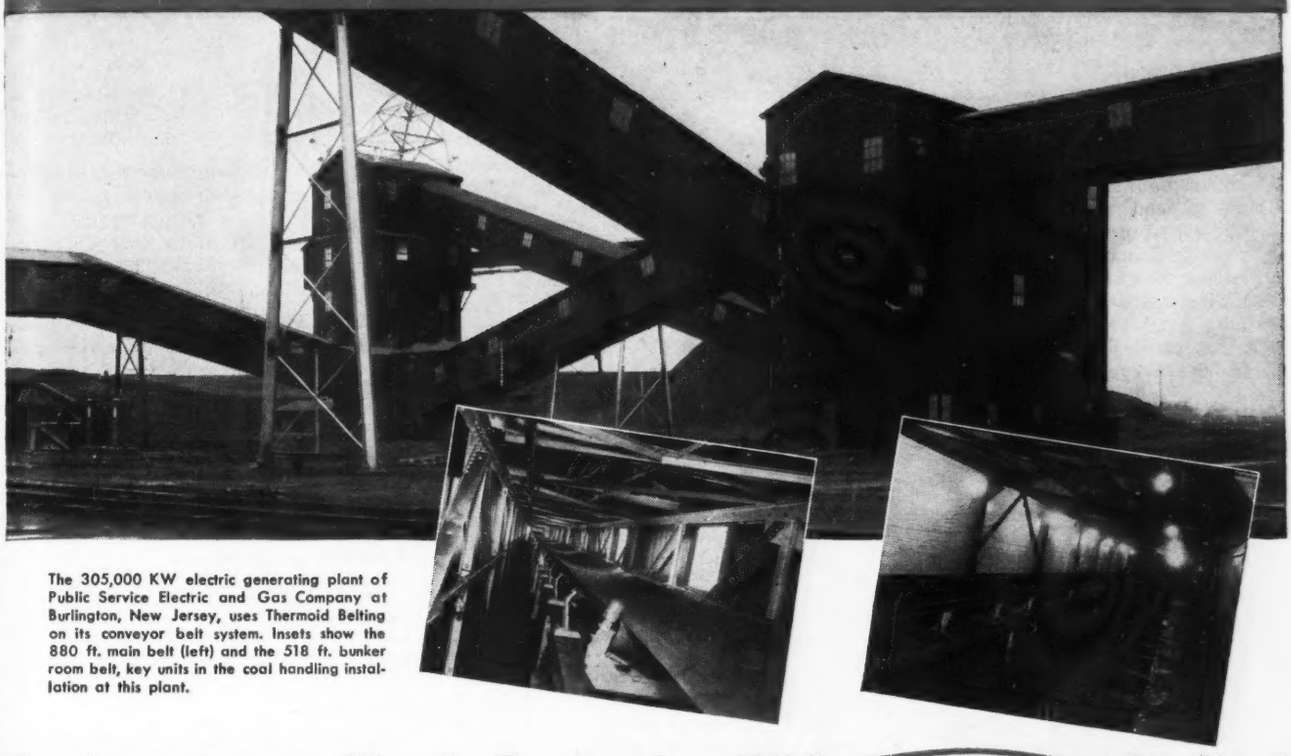


Here's one economical way to provide storage capacity for mine ore. Instead of building conventional storage bins and chutes at the portal of the Rifle mine, The U. S. Vanadium Corporation, Rifle, Colo., constructed this concrete-floored loading area with draw hole in the center. The ore is scraped into trucks spotted beneath the draw hole as shown in this sketch supplied by John Lloyd, superintendent of the Rifle mine.

Standard dumping ramps at track elevation are used to dump Granby-type mine cars. Air-operated pistons advance or retract these ramps, depending upon where the mine crew wishes to dump the loads. See photograph of air cylinder operating ramp at right.

A three-drum, 50-hp. hoist operates the scraper. One drum controls the tail rope. The tail sheave is supported by a chain, and may be hooked to a number of places as indicated. The two remaining drums of the hoist are used to pull the scraper to the draw hole. These versatile features permit the scraping of ore from many positions in the pit, and allow scraping to proceed in one place while ore is dumped in another.

$35,000 Worth of Conveyor Belting!



The 305,000 KW electric generating plant of Public Service Electric and Gas Company at Burlington, New Jersey, uses Thermoid Belting on its conveyor belt system. Insets show the 880 ft. main belt (left) and the 518 ft. bunker room belt, key units in the coal handling installation at this plant.

An Investment Worth Protecting With Thermoid Quality!

Your Thermoid Distributor can give you delivery dates— on the type of Thermoid Conveyor or Elevator Belting you need.

This generating plant can handle 500 tons of coal an hour on the 3874 ft. of Thermoid Conveyor Belting that equips its unloading and distributing system. This three-quarters of a mile of belting cost $35,000; an investment that must pay off, year in and year out, in terms of maximum tonnage per belt-dollar.

When the Thermoid Trade Mark is on such belting, everyone, from top management down, knows that the Purchasing Agent is buying the best that can be had.

The men responsible for maintaining equipment of this type will be glad to know that through increased production, deliveries of Thermoid Conveyor and Elevator Belting are again predictable and that Thermoid products, carefully made of the toughest materials by skilled craftsmen can now be ordered for replacements long overdue.

It's Good Business To Do Business With Thermoid!

Thermoid
INDUSTRIAL RUBBER PRODUCTS
BUILT FOR THE JOB
QUALITY VALUE SERVICE

Thermoid Products

AUTOMOTIVE • INDUSTRIAL
OIL FIELD • TEXTILE

THERMOID COMPANY, TRENTON, N. J., U. S. A.

THE THERMOID LINE

Includes: Industrial Brake Linings and Friction Products • Transmission Belting • Light Duty and Multiple V-Belts • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose

PERSONAL NEWS

Andrew Fletcher has been elected president of the St. Joseph Lead Co., succeeding **Clinton H. Crane**, president of the company for the last 34 years, who assumes the newly created position of chairman of the board of trustees. A graduate of the Sheffield Scientific School, Yale University, Mr. Fletcher was associated with the shipbuilding industry in an executive capacity until 1929, when he joined the St. Joseph Lead Co. as vice president and treasurer. Since May, 1946, he

ANDREW FLETCHER

has served as executive vice president. He is vice president and treasurer of the American Institute of Mining and Metallurgical Engineers, and a director and chairman of the finance committee of the American Mining Congress.

Henry B. Van Sinderen has resigned as chairman and director of the Callahan Zinc-Lead Co.

James H. Taylor has been appointed general mine foreman at the Portovelo property of the South American Development Co., in Ecuador.

E. R. Marble has been appointed manager of the Tacoma smelting plant of American Smelting & Refining Co. to succeed **E. A. White**, who is retiring. **Paul Benson** replaces Mr. Marble as general superintendent.

S. H. Williston, vice president and treasurer of the Cordero Mining Co., has returned to his headquarters at 57 Post St., San Francisco, Calif., following a professional trip to Washington, D. C.

Fred Knight, superintendent for the Oliver Iron Mining Co. on the Marquette Range, has retired. He has returned to his home at Iron Mountain, Mich.

Pierre Jouven, general manager of Alais Froges et Camargue cie, of Paris, France, together with **Maurice Zuber** and **Claudius Loeffel**, were recently in Spokane, Wash., making a study of the Kaiser company's Trentwood and Mead aluminum plants. They planned also to visit the Oakland, Calif., and Baton Rouge, La.. plants before returning to France.

Joel D. Wolfsohn, associate director of the Bureau of Land Management, has resigned to become director for Europe, North Africa and the Middle East for the American Jewish Committee. Mr. Wolfsohn had served with the Government since 1934 and the Department of the Interior since 1937. His successor has not been named.

Nathan R. Sewell, a graduate of the Georgia School of Technology and the Missouri School of Mines, has been appointed a research engineer in the North Carolina State College department of engineering research, at Raleigh, N. C.

E.&M.J. has a vacancy on the editorial staff for a technically competent man of agreeable personality, and having journalistic ability. Reduction metallurgist preferred. If interested, send qualifications, photo and references.

George W. Robinson, formerly manager of Stadacona Mines, Ltd., has accepted appointment as mine manager of Beattie Consolidated Mines, Ltd., Duparquet, Quebec, succeeding **H. S. McGowan. Robert Devlin** replaces Mr. Robinson as manager at the Stadacona property.

Dr. George S. Hume has been appointed chief of the Bureau of Geology and Topography in the Mines and Geology Branch of the Dominion Department of Mines and Resources, Ottawa, Canada.

Bruce O. Strachan, general superintendent for the Oliver Iron Mining Co. in the Vermilion district, Minnesota, with offices at Ely, retired on April 30 after 40 years of continuous service with the company.

Wendell T. Brown has been appointed superintendent of the Trench unit of American Smelting & Refining Co., at Patagonia, Ariz. He succeeds the late **Charles B. Hanraty.**

J. G. Symons has been appointed underground manager of North Broken Hill, Ltd., Broken Hill, New South Wales, in succession to **A. R. West**, who was named general manager of the company.

C. Blazey, chief metallurgist, Metal Manufacturers, Ltd., Port Kembla, New South Wales, has been elected a vice president of the Australasian Institute of Mining and Metallurgy.

Stanley C. Robson, a British authority on lead and zinc smelting, has arrived in Australia to assume his new duties as consultant to Zinc Corporation, Ltd. and Broken Hill Associated Smelters Pty., Ltd.

Clinton H. Crane was reelected president of the Lead Industries Association at the annual meeting held in New York May 9. **Kenneth C. Brownell** and **F. W. Rockwell** were named vice presidents. **Robert L. Ziegfeld**, who has been associated with the organization since 1929, has been named acting secretary and treasurer following the recent resignation of **Felix E. Wormser** as secretary.

A. J. Keast, general manager of Broken Hill Associated Smelters Pty., Ltd., Port Pirie, South Australia, has been elected a vice president of the Australasian Institute of Mining and Metallurgy.

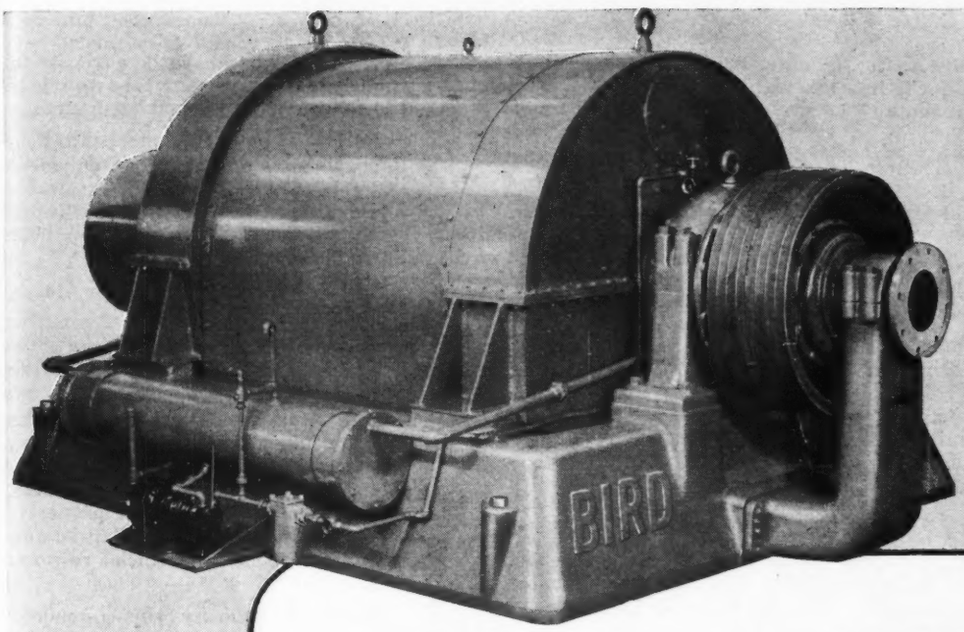
H. St. J. Somerset has resigned as managing director of Electrolytic Zinc Co. of Australasia, Ltd., and will be succeeded by **Harry Hey**, formerly general manager.

W. T. Warren has resigned as general superintendent of National Tunnel & Mines Co., Tooele, Utah, after twelve years' service with Anaconda Copper Mining Co. and is now consulting representative of International Explosives Corporation, with headquar-

W. T. WARREN

ters in Reno, Nev. **J. J. Lillie**, manager of operations of Mountain City Copper Co.. Rio Tinto, Nev., subsidiary of International Smelting & Refining Co., is acting as general superintendent for National Tunnel & Mines Co., succeeding Mr. Warren.

Dr. John S. Stevenson, of the British Columbia Department of Mines, has been awarded a fellowship of the Gug-



KNOW WHAT THIS BIRD CAN DO TO CUT *Your* FLOTATION COSTS?

Desliming your cell feeds by running them through this BIRD Centrifugal Classifier may make a big difference in cell capacity and cost of reagent.*

The BIRD takes out slimes as fine as 2 microns, without chemical dispersion. It handles up to 100 tons or more per hour, continuously, for months without a maintenance shutdown.

The magnitude of the potential savings warrant looking into this BIRD. For further details get in touch with *Bird Machine Company,* South Walpole, Massachusetts.

*In some cases reagent expense has been reduced as much as 60% without sacrificing yield.

The BIRD Centrifugal CLASSIFIER

genheim Memorial Foundation . to carry out a study of ores and rocks in British Columbia's coastal mountain ranges.

E. P. Crawford, president of Ymir Yankee Girl Gold Mines, Ltd., has been elected president of Reno Gold Mines, Ltd.

James Dickson has retired after serving for 21 years as Chief Inspector of Mines for British Columbia.

O. B. J. Fraser, assistant manager, Development and Research Division, International Nickel Co., Inc., is the new chairman of the New York section, American Institute of Mining and Metallurgical Engineers, succeeding **Edward Meagher,** of Texas Gulf Sulphur Co.

Frank H. Bishop, of Cleveland, Ohio, has resigned as manager of the Parts Manufacturing Division of the Lamp Department of the General Electric Co. to become vice president and general manager of Tungsten Mining Corporation, with headquarters at the

FRANK H. BISHOP

mine, near Henderson, Vance County, N. C. During the war he served on the Tungsten and Molybdenum Advisory Committee of the War Production Board. Tungsten Mining Corporation is jointly owned by Haile Mines, Inc., and **General Electric Co.**

Wesley Moulton has been appointed superintendent of the Cresson mine, Cripple Creek, Colo., succeeding the late **John Stark.**

Frank B. Morehouse is general superintendent of the Big Wedge mine of Atok Gold Mining Co., reportedly the first gold mine in the Baguio area of the Phillippines to return to large-scale production. **Douglas Strachan** is mine superintendent. **Walter Neal** has returned to the United States after supervising repairs to the milling plant, which he built before the war. He is replaced by **G. Scheuermann.**

Harry J. Wolf, who served with various metal and non-metallic sections of the Office of Production Management, War Production Board, and Foreign Economic Administration during the war, recently completed a two-year program of research relating to aluminum, aluminum metallurgy, and associated projects as research engineer for the Reynolds Metals Co. at Glen Cove, N. Y., and has returned to professional practice as a mining and consulting engineer.

Recent visitors in the Aspen, Colo., mining district were **Fred Johnson,** manager of the western division of the mining department of American Smelting & Refining Co.; **J. Paul Harrison,** Colorado manager for American Smelting & Refining Co.; and **J. W. Patterson,** chief engineer of the Pacific Bridge Co.

N. A. Dumbleton, manager of the Golden Valley mine. Southern Rhodesia, is taking a leave of absence to visit Canada and the United States. He will stop en route in Australia.

A. S. Baillie has been elected president of Granby Consolidated Mining, Smelting & Power Co., Ltd.

Jack Lee has been named superintendent of the Goldroad mine, at Goldroad, Ariz., replacing **Guy Gardner,** who has retired because of ill health.

E. Roland Harriman, chairman of the Union Pacific Railroad and a director of Anaconda Copper Mining Co., visited Butte, Mont., early in May, accompanied by a group of railway officials.

OBITUARIES

Carlos Whitney Van Law, 73, mining engineer with the Vanadium Corporation of America, New York, and vice president of its subsidiary, Rhodesian Vanadium Corporation, died on Feb. 26.

Following his graduation from Cornell University in 1896, where he was a member of Sigma Psi, engineering honorary society, Mr. Van Law was engaged for many years in extensive mine work for Mexican, Central American and South American enterprises and, after joining the Vanadium Corporation of America in 1942, made a survey of their chrome mines in Southern Rhodesia.

He was a member of the American Institute of Mining and Metallurgical Engineers, the Mining and Metallurgical Society of America, and the Mining Club of New York.

James Anderson died in Vancouver, B. C. April 29 at the age of 73. He was secretary of Sheep Creek Gold Mines, Ltd., Zincton Mines, Ltd., and Utica Mines (1937), Ltd., and formerly a director of Gold Belt Mining Co., Ltd.

J. O. B. Keener, superintendent of the Stratton Cripple Creek Mining & Development Co., and well known throughout the West for his activities in mining and oil, died April 18 in Colorado Springs, Colo. He would have been 70 in July. Mr. Keener was instrumental in bringing about the reopening of many mines in Cripple Creek, and was an early advocate of the use of geophysical means as aids in the determination of oil structures.

Burdett Loomis Jr., a pioneer in Polk County, Fla., phosphate development and retired manager of the American Agricultural Chemical Co., died April 27 at his home in Longmeadow, near Springfield, Mass.

Carl F. Whitham, 64, pioneer Alaska mining man and president and manager of Nabesna Mining Co., died March 30 at a hospital in Seattle, Wash.

John Stark, superintendent of the Cresson mine, at Cripple Creek. Colo., lost his life April 9 while trying to rescue two miners from a gassy area on the 1,000-ft. level of the property. On reaching the level he collapsed and failed to respond to artificial respiration.

Charles B. Hanraty, superintendent of the Trench unit of American Smelting & Refining Co., at Patagonia, Ariz., died of a heart ailment April 28. Well known in Arizona mining circles, Mr. Hanraty had been with the A.S. & R. company since 1940.

LETTERS

Efficiency Incentives In Premium Price Plan

The Editor:

I read with interest your editorial comments on the Russell Bill in your May issue, particularly those regarding the dangers of a cost-plus system and the tendency toward inefficiency in a direct subsidy. These are real hazards. Few mining people know that as now administered the Premium Price Plan has two well-developed safeguards against them.

An applicant for premiums furnishes to the administrators a specified forecast of grades of ore and tonnages to be produced, development and extraction costs to be incurred, and income to be realized from sales of ore, concentrates, or metals; that is, a budget for future months. This forecast is analyzed and compared with past performance by experienced engineers before a premium is assigned.

This assigned premium will not be increased in the future unless the operator can demonstrate that an increase is necessary due to changed conditions.

No retroactive increase will be made in the future unless an arithmetical error has occurred in the calculation of the premium.

Thus, an operator is in effect assigned a price in advance, based on his own budget, from which there is no recourse if he exceeds the budget. This is the opposite of cost-plus, in which payment of costs plus profit is made *after* the costs have been in-

curred and determined.

The incentive to efficiency is provided in the operating margin added to costs in calculating the premium to be assigned. The basic principle upon which this margin is calculated is, "the lower the cost per pound of metal, the higher the operating margin per pound of metal." For example: An operator with a cost per pound of 14.9¢ is assigned a basic margin per pound of 0.494¢; an operator with a cost per pound of 12.7¢ is assigned a basic margin per pound of 0.650¢.

In its present form this incentive is weak. The margin scale for the war years was set on a very slowly declining gradient, since it was realized that cost increases beyond the operator's control would be the rule during that period. On a Western ore containing 100 lb. of recoverable lead-zinc, for example, an operator whose costs increased by $1 a ton of ore would lose only 5¢ a ton in margin. Conversely, if he could cut his costs by $1 a ton, he would gain only 5¢ a ton additional margin.

Plans were on the boards to change this gradient to about 40¢ per $1 in 1946, when the Congress inserted into the appropriation bill the 'terms as favorable as heretofore" clause. Counsel were of the opinion that this prohibited change of the gradient, since increased rewards to efficient operators would conversely gore inefficient operators, causing them to be treated on terms less favorable than heretofore.

JESSE L. MAURY

Chevy Chase, Md.
May, 1947

Speaking of the Devil and His Due

The Editor:

I refer to your editorial, "Confidence in Gold Returning," which I read with a great deal of interest.

It is probably true, as you state, that "The Economists' National Committee on Monetary Policy . . . is not identified with any (gold) producer interest." This statement, however, places a halo on this Committee's head that it does not wholly deserve. In other words, as has been pointed out in your magazine, the Economists' National Committee on Monetary Policy is substantially financed by silver consumers.

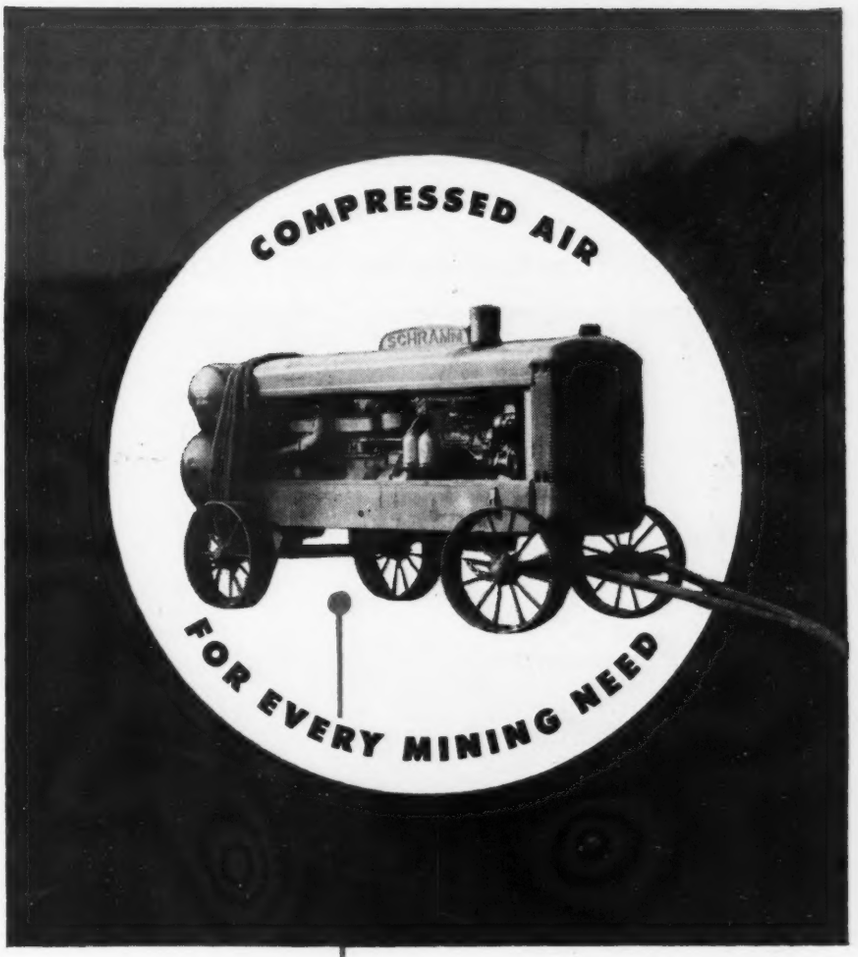
Thus, the Committee in its efforts in behalf of gold is to a considerable extent masquerading in sheep's clothing for the purpose of sabotaging silver.

I am quite willing for the devil to be given his due, but I cannot let the statement pass without calling attention to his tail and talons.

FRANK LILLY

Spokane, Wash.
April 17, 1947

The statement was not intended to adorn the reputation of a group whose subservience to the interests of silversmiths is quite obvious.—Ed.



Here is another mining job calling for a Schramm Air Compressor . . . one of many uses for Schramm in the mining industry!

Schramm Compressors are called the "versatile" Compressors because they do *so many jobs* around the mine, *simplifying your demands for air where you want it!*

Users of Schramm Air Compressors list these features as outstanding: (1) 100% watercooled (2) mechanical intake valve operating from cam in perfect timing (3) forced feed lubrication (4) larger discharge valve with lower lift adding to efficiency.

Too, there's a push-button to allow instant starting. Every Compressor is compact, lightweight, easy to move about on the job.

For full construction details, write today for your copy of bulletin COM-45.

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THE COMPRESSOR PEOPLE
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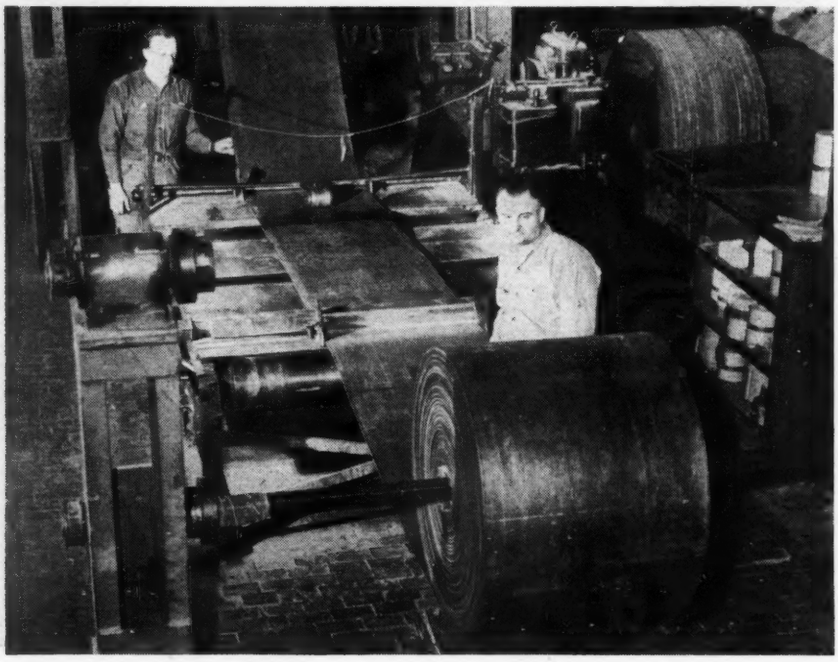
EQUIPMENT NEWS

New Construction Quadruples Conveyor Belt Strength



A new conveyor belt 250 to 400% stronger than previous rubber-fabric belts has been developed by United States Rubber Co., Passaic, N. J. The increased strength has been obtained by a new textile construction of nylon and Ustex yarns that increases the permissible working tension of each ply by 2½ times.

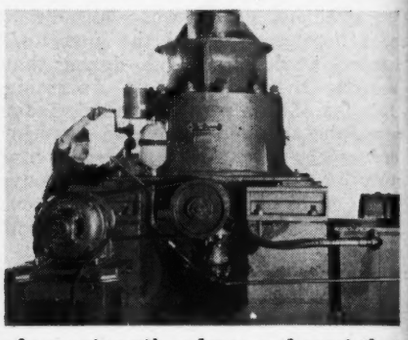
In addition to greater strength, the new belt is said to have the advantages of low stretch lengthwise and increased flexibility crosswise. Longer and heavier belts can thus be built with a minimum of stretch and with excellent troughing qualities. In a demonstration of the new belt, it was shown that for belts of equal strength the old type construction would produce a belt that would trough only under heavy load. The new type belt troughs readily under its own weight.

Ustex yarn is a development of U. S. Rubber that was used during the war to make parachute harness. This new belt is its most important postwar application.

The range of conveyors has been extended by means of the new belt, the company states, and maintenance costs can be cut through its use. Being made solely of fabric and rubber, the belt can be vulcanized into an endless belt on the job. If it is cut or torn accidentally, repair in the ordinary way is a simple matter.

Protection for Crusher

Unbreakable material, which might otherwise damage the crusher, is discharged safely from Allis-Chalmers Type R reduction crushers by means

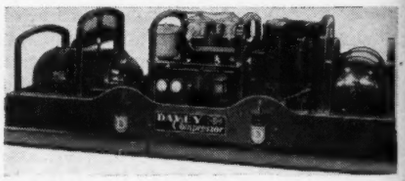


of an automatic release and reset that lowers the crushing head and returns it to its setting after the danger has passed.

Recently developed by the company, the device functions separately from the speed set control that adjusts size of product. When unbreakable objects enter the crushing chamber, pressure in the hydraulic system increases enough to compress a gas-filled bag, which permits oil to enter the automatic reset's steel shell and causes the crushing head to lower and release the hard object. When the head is again free, the oil is forced out of the reset, and the head is returned to operating position. Pressure on the reset is adjustable to meet a variety of crushing conditions.

Air for Tunnel Work

Compressors mounted on mine-car chassis are available from Davey Compressor Co., Kent, Ohio. The cars are

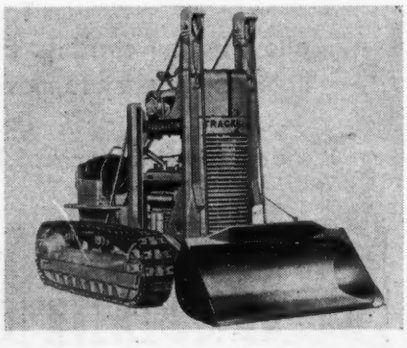


made for standard or narrow-gage track; springs and wheels are standard mine-car type. Drive is by electric motor or gas or diesel engine, and self-propelled cars can be made on special order. The unit is made in five sizes from 60- to 315-c.f.m. capacity.

New Excavator

With the recent announcement of the Model T-6 Traxcavator, the Tracksson Co., Milwaukee 1, Wis., has expanded its line of tractor excavators to fit all four sizes of Caterpillar track-type tractors. The full line includes bucket sizes ranging from ½ to 4 cu.yd.

Shown in the accompanying photograph, the T-6 Traxcavator is mounted on the D-6 Caterpillar. It has a bucket of 1½ cu.yd., with 1¾-cu.yd. bucket or bulldozer blade interchangeable. The unit is suitable for loading haulage units, or for any one of a great variety of materials-handling jobs, examples of which will be furnished by the manufacturer.



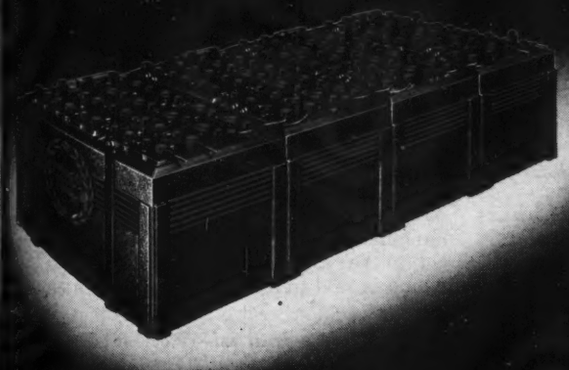
Quick-Change Goggles

The M.S.A. Speedframe, recently announced, is a gas-welders' goggle that can be raised or lowered by a nod of the wearer's head. Made by Mine

Power for Greater Production

To get out more tonnage, at lower cost, equip your hardworking shuttle cars, locomotives and trammers with modern extra capacity Philco Mine Batteries. This extra capacity of 10% or more—an original Philco development—is available in several modern Philco types including the famous long-life Philco "Thirty" Mine Batteries.

Write for latest catalog of specification data



PHILCO

STORAGE BATTERIES

PHILCO CORPORATION • STORAGE BATTERY DIVISION • TRENTON 7, NEW JERSEY

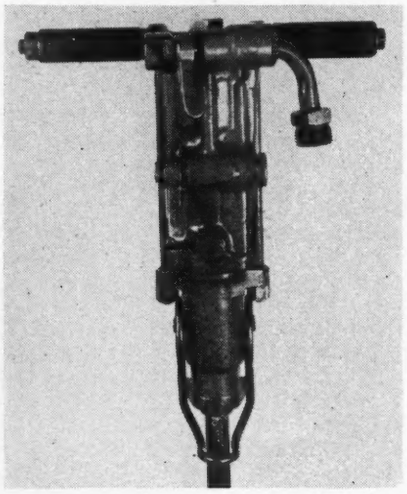
Safety Appliances Co., Pittsburgh 8, Pa., the Speedframe consists of suitable goggles mounted in a light fiber headframe that holds them in either up or down position without uncomfortable pressure on temples or bridge of nose. Bulletin No. CE-7 describes the appliance.

Heavy Feeder

Brute strength and dependable service are said to characterize the new feeders for mining and related heavy industries being built by Pioneer Engineering Works, under license from Kensington Steel Co. Made of Oro Supermang steel, the feeder is heavily built to withstand severe shock and abrasion. It is furnished in pan widths from 36 in. to 48 in. and in lengths from 6 ft. 3 in., to 16 ft. 9 in. For details, address Pioneer Engineering Works, Inc., 1515 Central Ave., Minneapolis 13, Minn.

A 30-lb. Jackhamer

Ingersoll-Rand announces a new lightweight rock drill in the 30-lb. class, the J-30 Jackhamer. Designed for drilling medium to hard rock, the

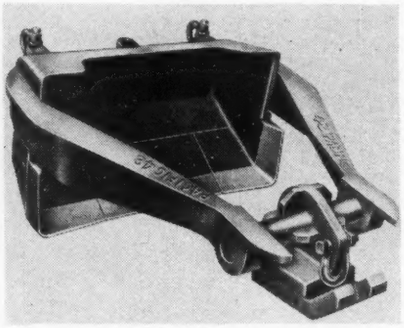


new drill is equipped with an extension grip handle and rider pads that make it easy to drill from a plank. The manufacturer suggests that the J-30 is particularly useful for drilling foundation holes in concrete, cutting hitches, block-holing, trimming and cutting trolley hanger holes. It is said also to have reserve power enough to handle occasionally the jobs of heavier machines.

New design features include: a three-in-one backhead that allows quick interchange among wet, dry, or blower operation; a new sealed throttle valve; stronger rifle bar; two-piece chuck, long-wearing piston. Bulletin 4059 describes the new Jackhamer. A new 82-lb. heavy-duty paving breaker, Model PB-8, recently announced by the company, is described in Bulletin 4051.

Balanced Drag Scraper

Balance to increase ease of digging and to reduce wear is one of the features of the line of Pacific drag



scrapers recently announced by Alloy Steel & Metals Co., Los Angeles, Calif. Designed so that the entire weight of the scraper goes into the digging action, the balance of the unit is such that when the scraper is loaded, the digging action ceases, relieving the hoist of excessive drag. On the back haul, the scraper tips back on runners that lift the cutting blade above digging level. This relieves the blade of excessive, non-productive wear.

Pacific scrapers are provided with newly-designed self-sharpening corner cutters that are said to assure effective digging action. The shoe is designed to protect the harness and cable shackle from wear. The scrapers are available in three models and six sizes from 26-in. to 60-in. They are described in Bulletin 128.

New Welding Rods

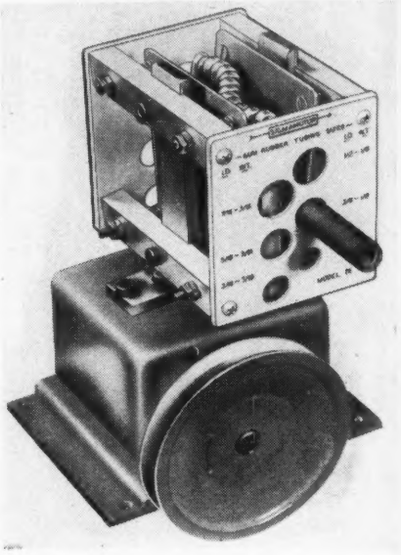
Announcement was made recently of two new welding rods: one for repairing cracks in cast iron and the other for arc-welding of stainless steel. The cast iron rod is offered by All-State Welding Alloys Co., Inc., White Plains, N. Y., and is suited for brazing cracks in motor blocks and cylinder heads and similar repair work. The stainless steel rod is offered in a complete line of grades and diameters by Wilson Welders and Metals Co., 60 East 42d St., New York 17, N. Y. Rods are furnished lime-coated for d.c. work, or lime-titania-coated for a.c. jobs. The a.c. rod is said to eliminate arc blow, to be easier manipulated, and to give a better appearing deposit.

Super Truck Tire

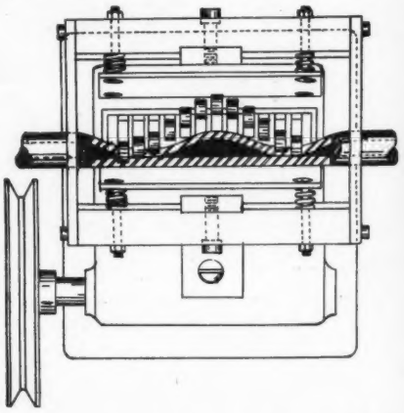
All plies are built of a newly-perfected nylon cord in the super truck tire recently announced by Goodyear Tire & Rubber Co., Akron, Ohio. Said to be the first truck tire with all-nylon plies to be sold, the new tire is reported to make available to truckers the greatest strength, resistance to bruising, and resistance to heat ever built into cord tires. First tire in the Goodyear line to use the all-nylon construction will be one designed for long distance high-speed service. Because of restricted supply of nylon cord, production of the new tires is limited.

Laboratory Pump

Laboratory leaching tests are dependent on some sort of pump for recirculation of solution, and various



ingenious devices have been built for this purpose. One of the most interesting to appear recently is the Sigmamotor, which is pictured herewith. The device is simply a means



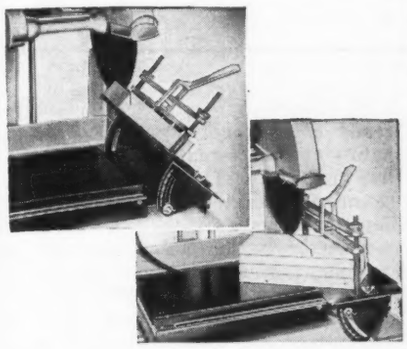
of converting a piece of rubber tubing into a pump.

As indicated by the drawing, the Sigmamotor is a positive-displacement pump that will develop and maintain vacuum equal to 29 in. of mercury and pressure above 15 lb. per sq. in. The laboratory model is designed for capacities of from 1 to 30 g.p.hr. It operates with a ¼-hp. motor.

Aid for Masonry Saws

Clipper Mfg. Co., Kansas City 8, Mo., maker of Clipper masonry saws, announces an adjustable material clamp as an accessory to the saw, which is said to make possible the easy

cutting of most intricate shapes and sizes of brick, tile, or firebrick. The clamp will take material up to 5 in.



thick and 12 in. wide. In use, material is placed on the cart in the desired position and locked into place with a clamping lever. It need not be held by hand thereafter.

BULLETINS

Drinking Fountains. Sanitary, portable drinking fountains, carrying four gallons, and built especially for mine or field use, are described in a new bulletin of Dobbins Mfg. Co., Elkhart, Ind.

Cutting Keyways. The only catalog in existance covering the subject of keyway broaches and kits and arbor presses is available on request to The du Mont Corporation, Greenfield, Mass.

Foundry Burners. Hauck oil and gas burning equipment for foundries is described in Catalog 1043 of Hauck Mfg. Co., Brooklyn 15, N. Y.

Portable Compressors. Davey Compressor Co., Kent, Ohio, has published a bulletin describing the new Davey Air Chief portable compressors.

New Tractors. Two folders, describing the power and work features of the new, more powerful, Caterpillar D6 and D4 tractors, have been published by Caterpillar Tractor Co. Peoria 8, Ill.

Non-Corrosive Pipe. Johns-Manville Co., 22 East 40th St., New York 16, N. Y., has published two new bulletins: one on the use of Transite pipe in mine service for corrosive water under pressure; and one on friction materials of various kinds for brakes and clutches.

Insulation Tester. The "Bridge-Meg" insulation tester, designed for use on insulation resistance tests and for all manner of coil, resistor, and circuit measurements, is described, and its applications suggested, in Bulletin 21-60-34, available from James G. Biddle Co., 1316 Arch St., Philadelphia 7, Pa.

Magnetic Clutches. A new catalog, No. 226, which is referred to as a complete text book on magnetic clutch application and specification, is available from Stearns Magnetic Mfg. Co., Milwaukee 4, Wis.

Control Instruments. Catalog No. 8302, recently published by Brown Instrument Co., Philadelphia 44, Pa., contains useful information on electric and pneumatic automatic control systems.

Jaw Crushers. Traylor Type H and HB jaw crushers are described in a new catalog, No. 3105, of Traylor Engineering and Mfg. Co., Allentown, Pa. Dimensions, capacities, assembly and operating instructions, including "exploded" drawings of both crushers, are given.

Diesel-electric. Witte diesel-electric power plants (largest size is 8kw.-10k.v.a.) are described in a new bulletin of Witte Engine Works, 1600 Oakland Ave., Kansas City 3, Mo.

Water Conditioning. A revised edition of Cochrane Publication 4021, describing carbonaceous zeolite water conditioning equipment for softening boiler feed and industrial process waters is now available from Cochrane Corporation, 17th St. & Allegheny Ave., Philadelphia 32, Pa.

Air-Dump Cars. A catalog listing and describing various automatic air-dump cars for sale at second-hand is available from Iron & Steel Products, Inc., Chicago 33, Ill.

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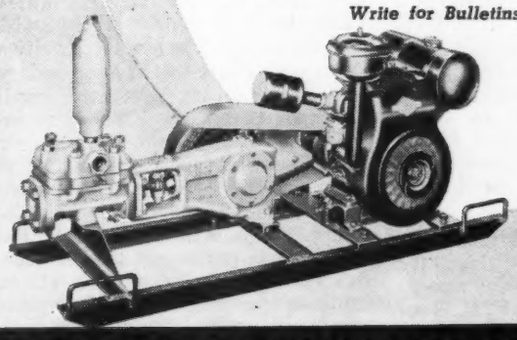

WE LOOK INTO THE EARTH

753A

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NEW BOOKS

STRATEGIC MINERALS. A SUMMARY OF USES, WORLD OUTPUT, STOCKPILES, PROCUREMENT. By John B. DeMille. McGraw-Hill Book Co., Inc., New York 18, N. Y. Pp. 626. Price $7.50.

One does not have to be very old to remember the seemingly interminable war minerals relief legislation that grew out of the problems of mineral supply of World War I, seeing that the final claim for "relief" was settled only two or three years ago. A book about those minerals, such as Mr. DeMille has now written about the war minerals of World War II, if we may call them that, would have been invaluable in the quarter century following the Armistice of 1918. Much of the delving for facts and figures that claimants and their attorneys were forced to do in order to prepare their cases would have been unnecessary had there been available an authoritative war minerals reference book and history of wartime official orders such as the volume just published.

This is by way of giving the reader an idea of the nature of Mr. DeMille's book and not by way of implying that we shall see a repetition of the litigation that was an unpleasant feature of the years following 1918. This time the various Government agencies did things better, we hope.

Some 76 metals and minerals are dealt with in 65 short chapters by Mr. DeMille. In each instance he discusses the properties and uses of the mineral, the matter of prices, the domestic sources of supply and production, also world production and imports and exports. His viewpoint is chosen with respect to world supply and output. For each mineral, moreover, he records the specific war orders issued and their respective effects. Introducing this section, which constitutes the bulk of the book, he reviews, in 27 pages, the wartime government regulations affecting procurement and production and the various stockpile directives. We should add that these details were at Mr. DeMille's fingertips during the war, by virtue of his position from October 1942 to July 1945 as senior engineer in the mining section of the Reconstruction Finance Corporation.

A. H. H.

THE AJO MINING DISTRICT. U. S. G. S. Professional Paper 209. By James Gilluly. For sale by Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. Pp. 112.

Based on work done during the period 1932 to 1934, this report covers descriptive geology, structure, physiography, geologic history, rock alteration, mineralogy, mining history, and ore deposition of the Ajo mining district, southern Arizona. Mineral occurrences are described fully in a section containing 54 photographs and microphotographs.

The last third of the paper deals with ore deposits and directly related subjects. An abstract of the full report appears at the beginning of the paper. Therefore readers whose main interest is in ore deposition may conveniently read the abstract and the last third of the report. This section contains a full description of the New Cornelia mine together with diamond-drill logs of the deposit, vertical and horizontal sections through the mine showing ore deposition and grades, and detailed geologic maps in color of the district and the immediate mine area.

The structural evolution of the east end of the Ajo Mountains is interestingly shown by a series of block diagrams depicting intrusion, faulting, erosion, sedimentation, and tilting.

THE PROBLEM OF REDUCING VULNERABILITY TO ATOMIC BOMBS. By Ansley J. Coale. Princeton University Press, Princeton, N. J. Pp. 116. Price $2.00.

There were five men adrift in a row boat in the Niagara River not far above the Falls. There were five oars in the boat and each man could row, but they couldn't seem to agree on who was to set the stroke. While they were arguing about it, the boat went over the Falls.

This sad and not very original story was evoked by a reading of Mr. Coale's report on what to do in preparation for atomic warfare. With none of the doom-cracking rhetoric affected by most atomic authors, Mr. Coale still freezes the blood by the very calmness with which he talks about casualties of 14.000.000 to 17,000,000 killed and 14,-000,000 wounded in our larger cities in the first few minutes of an atomic war. It is only too apparent after reading this book that there is really no practicable solution to the problem, short of preventing such wars, and that while our Big Five "statesmen" argue over ideologies and empires, our boat of civilization is headed over the Falls.

Mr. Coale points out that in four or five years, several countries will each probably possess stocks of thousands of atomic bombs. The problem then is to prevent their use as bombs, or to survive if they are used. If we have an adequate international control system, there is no problem; if a full-scale atomic war starts, we can avoid practical annihilation only by having already completely inverted our living habits and scattered from our cities to live in caverns. The statistics of Hiroshima, Nagasaki, and Bikini prove this beyond argument.

Even worse than Mr. Coale's precise treatment of atomic bombings is his brief sketch of the possibilities of mass murder by radioactive poisons or by simple bacteria. The bomb seems clean and humane by comparison.

It seems obvious that to guard ourselves against this sort of thing, we would have to abandon every principle of our democratic way of life and give ourselves over to central military planning authority, which would shift our population and our industries, design and construct our underground villages, direct our every activity toward the essential end of survival under atomic attack. That is the only way by which such sweeping changes in our economy could be made.

The alternative to this suicide of democracy would be to see to setting up an international police force that would control atomic energy and prevent war. Everybody thinks this would be a good idea, but few think it is practical.

Thus it appears that nothing is practical but the extinction of civilization. If that statement is valid, perhaps it is just as well.

R. H. R.

ENGINEERING PROBLEMS MANUAL. By Forest C. Dana and Lawrence R. Hillyard. McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. Pp. 413. Price $3.25.

First issued in 1927, this text, designed to aid engineers to learn how to compute accurately, easily, and neatly, has been revised to include ideas gained by the authors in engineering instruction during the war. To one who is glad his days of instruction in mathematics are behind him, this book seems as alive and modern as such books can be made, and if one can not learn to solve problems by the methods outlined here, he is beyond hope.

As an illustration of the authors' awareness of the problems and attitudes of engineering students, one might mention certain paragraph headings. For example, the book discusses: "Getting Along with College Professors," "The Art of Apple Polishing," "How to Flunk Out," "Method of Attacking a Problem," and similar essential, but often neglected, aspects of student life.

This is not to say that the book is a kind of "Calculus in 10 Easy Lessons." Far from it. Computation is serious

business, and the student will be made to realize it. What the authors do is encourage the student to find within himself the courage to tackle the toughest problems, and to develop the resources to solve them. Textbooks like this one are the finest sort of aid to a student, and there ought to be more of them.

DIESEL EQUIPMENT IN UNDERGROUND MINING. Information Circular 7406, U. S. Bureau of Mines. By D. Harrington, chief, Health and Safety Branch, and J. H. East, mining engineer. Pp. 87.

Mining men who are following the growing use of diesel-powered equipment underground will find this report useful as a reference. It contains a thorough review of the performance of diesel locomotives and equipment in this country and abroad.

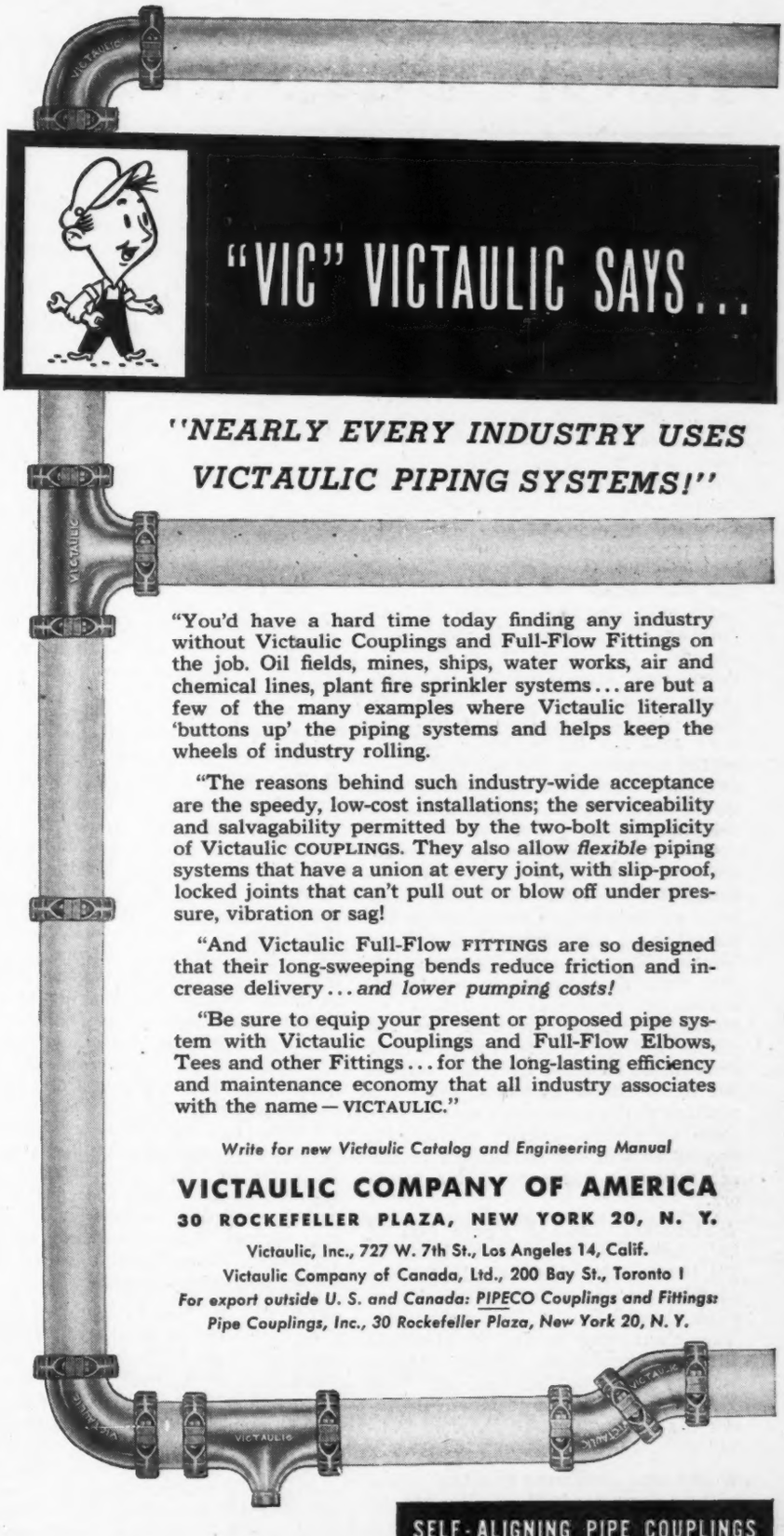
As the safe use of diesel power underground hinges upon dependable methods of removing and/or diluting noxious and objectionable gases from engine exhaust, the report places much emphasis on this subject. Topics discussed are: gases evolved in the exhaust of a diesel engine; testing diesel locomotives for permissibility; maximum permissible limits of toxic gases; protective devices; and methods to calculate the minimum amount of ventilating air required to operate a diesel engine underground.

GENERAL SURVEY OF GERMAN BATTERY INDUSTRY. Office of Technical Services, Department of Commerce, Washington 25, D. C. Pp. 40. Price: photostat, $3.00; microfilm, $1.00. Make check or money order payable to Treasurer of United States.

Details on the manufacture of sintered plates for the nickel-cadmium alkaline batteries developed by the Germans are contained in a U. S. Army report available at the address given above. Being porous, the sintered plates needed no grid structure to hold the active anodic or cathodic materials, which in this battery are deposited electrolytically directly in the pores.

Carbonyl nickel composed the sintering powder for the positive base plate; the negative plate was made of a mixture of 30% carbonyl nickel and 70% copper. Powder for each plate was molded, then sintered. The positive plates were then impregnated with nickel nitrate solution and electrolyzed cathodically in sodium hydroxide solution. Pure nickel formed the anode. The negative plates were treated similarly with cadmium chloride and a cadmium anode.

Used in Europe for more than 20 years, the cadmium-nickel alkaline storage battery is now being produced in the United States. It is said to possess certain favorable maintenance and operating characteristics.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REGIONAL NEWS

UTAH

District union defers action on secession—New Park and North Lily show higher production

★ A threatened strike by 130 employees of Bingham & Garfield Railway Co., called for April 24, which would have thrown out of work approximately 5,000 employees of Kennecott Copper Corporation and the American Smelting & Refining Co., was postponed indefinitely. B. M. Alvord, of Cleveland, Ohio, vice president of the Brotherhood of Locomotive Firemen and Enginemen, and R. O. Hughes, of Cedar Rapids, Iowa, vice president of the Order of Railroad Conductors, announced the postponement about nine hours before the strike was to have taken place. Alvord said the brotherhoods had accepted the offer of the national mediation board to mediate the dispute and would defer any strike action for "a reasonable time."

The strike threat arose over the status of persons to be hired to operate the new industrial line being built by Kennecott Copper Co. to replace the old Bingham & Garfield line. The brotherhoods seek a commitment that when the new line goes into operation its employees will retain the status of railroad workers and the rights granted under the Railroad Retirement Act and the Railroad Labor Act of 1934. Kennecott takes the position that as the new line will perform no common-carrier service, its employees will not be subject to the acts covering common carrier workers.

★ Structural Steel & Forge Co., of Salt Lake City, was high bidder at $81,400 for the chemical plant operated during the war by U. S. Vanadium Corporation at Salt Lake City. The plant was owned by Defense Plants Corporation. Other bidders were Pamill Corporation, of New York City, $75,137; and Morse Brothers Machinery Co., of Denver, $74,743.

★ The next movement in metal prices will be downward, H. Y. Walker, of New York City, American Smelting & Refining Co., predicted in Salt Lake City May 3 on his arrival to attend a five-day conference of 25 of the company's managers.

"Because of sharply increased costs for labor and materials, I don't think that prewar metal prices can bring out the needed production," Mr. Walker said; "therefore the future level of these prices will be higher than the average before the war."

★ Locals of district No. 2, International Union of Mine, Mill & Smelter Workers, CIO, will decide whether or not to secede after they have received and studied the report to be made by a special committee appointed by Philip Murray, CIO president. Decision on the matter followed prolonged and acrimonious debate at the recent district conference in Salt Lake City.

Another resolution adopted by the conference approved the establishment of company-wide bargaining councils, with the small unions representing single - property operators forming a miscellaneous council. It also directed the district general wage policy committee to coordinate activities of the bargaining councils in an advisory capacity.

Reid Robinson, former international president and personal representative of the incumbent president, Maurice E. Travis, tried to get the floor several times, but objections were raised and upheld by delegates. Orville Larson, international board member from the district, was permitted to speak in behalf of Robinson. Ralph H. Rasmussen, former international vice president, who said he was "counted out" of the office through corrupt election practices last fall, was permitted to deliver a scathing address attacking the Robinson-Travis faction.

Prior to opening of the convention, J. Frank Marble, conservative who reported having openly advocated secession, resigned, charging that communism "has an almost unrestricted control over our international union." He retained office until May 1, enabling him to conduct the convention, and appointed George Wilde, of Tintic, former vice president, as his successor. The executive board sustained the appointment.

★ Charles R. Brooks, of Salt Lake City, president of local 692, Non-ferrous Clerical & Technical Workers (MMSW), is chairman of the Kennecott council of labor, which includes 18,000 employees of Kennecott Copper Corporation, in Utah, Arizona, New Mexico, and Nevada. He was elected at a two-day meeting of council representatives from the four-state area held April 20 and 21. Kennecott contracts dating from June 12 to June 30 will be reopened in Utah, he said, with wages the principal matter of discussion.

★ New Park Mining Co., of Keetley, earned a gross income of $426,963 in 1946, compared with $302,214 in 1945, W. H. H. Cranmer, president, reports. Net income before depletion was $236,000 in 1946, compared with $259,348 in 1945.

★ North Lily Mining Co., Eureka, subsidiary of International Smelting & Refining Co., had a 1946 net income of $96,425 before depletion, compared with $64,113 for 1945. Total income was $209,618 in 1946.

NEVADA

Combined Metals increasing mill capacity — High-grade ore face reported at Deep Mines

★ Combined Metals Reduction Co., foremost far-western producer of zinc-lead-silver concentrate from its Caselton selective-flotation mill, at Pioche, with two 500-ton circuits, is increasing plant capacity to 1,500 tons per day by the addition of seven flotation cells and mill units designed to improve screening and grinding procedure, E. H. Snyder, president, has announced.

★ Consolidated Coppermines Corporation, with mines at Kimberly and product treated at Kennecott's McGill plant, reports 1946 net earnings of $858,884, or 54¢ per share, before depletion, compared with $435,887 net., or 27¢ per share, in 1945. Figures do not include the corporation's interest in earnings of the Titan Metal Manufacturing Co., of Bellefonte, Pa., control of which was purchased in December 1946. In his report the late John A. Payne, president, said there was still a shortage of underground miners, but that 61% of last year's production came from open-pit shovel operations.

★ The lately organized Tonopah Development Co., represented by M. A. Diskin, of Reno, former State Attorney General, has awarded a contract to the E. J. Longyear Co. for deep diamond drilling on a group of more than 20 lode claims a mile north of Tonopah, including patented ground purchased from Nye County. Longyear crews were reported drilling two 1,000-ft. holes a short distance north of the old Victor shaft of the Tonopah Extension Co. O. I. Lavrooshin is engineer in charge for the new company.

★ Cinnabar holdings and other assets of the Horse Heaven Mines, Inc., in southwestern Oregon, a former producer, have been transferred to Cordero Mining Co., with a mine and an 80-ton plant in Humboldt County.

Nevada, a leading mercury producer during the war. Both companies are said to be controlled by J. Edgar Pew, of the Sun Oil Co., Philadelphia.

★ A mass of low-grade ore estimated at over 20,000 tons was blasted into the open pit recently at the Standard Cyaniding Co. mine, in Pershing County. Diluted by overburden, this ore is believed by H. L. Hazen, president and manager, to have a value of $1.50 per ton, and it will eventually be treated. While the main orebody at the south is being stripped, the cyanide mill, which had been treating around 650 tons per day, is said to be treating old tailings.

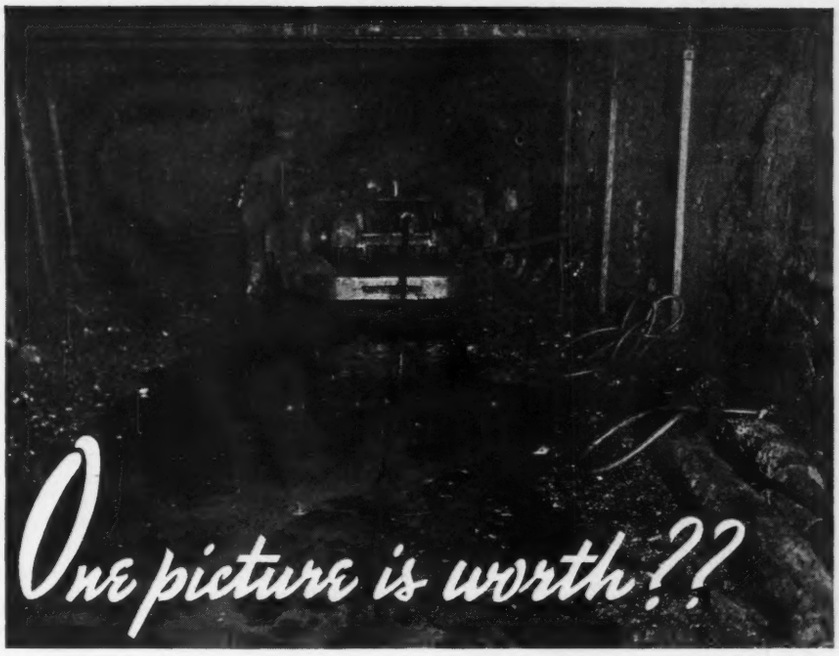
★ The bucket-line dredge of Manhattan Gold Dredging Co., operated for several years in Manhattan Gulch by the Natomas Co., was closed down early in the winter and will be dismantled. Extended drilling of the alluvial fan area in the valley failed to indicate gravel of sufficient value to warrant returning the unit through the 4-mile gulch. It was indicated that the dredge may be moved to the Greenan placer at Copper Canyon, leased by Natomas.

★ Mountain City Copper Co., Anaconda unit operating at Rio Tinto, Elko County, reported 1946 net income of $1,305 before depletion and including premiums, compared with 1945 net loss of $14,388. The ore reserve, it was stated, amounts to less than a year's supply at the current rate of exhaustion. Some ore was found in extending the 400-ft. level in the eastern part of the Rio Tinto mine, and work continued in this area.

★ Getchell Mine, Inc., preparing to resume milling on a part-capacity basis as soon as certain units are obtainable, reports extensive metallurgical testing, both on laboratory and milling scales, during the past year. The new three-compartment North shaft was sunk to the 600-ft. horizon of the main workings, and a 650-ft. crosscut was nearing the ore zone. Large orebodies were opened by a series of crosscuts from the north and south open pits. The tungsten plant, installed in the mill structure, completed concentrating 80,830 tons of scheelite from Government stockpiles and the company's nearby mine.

★ Sampling and survey work to include the reopening of old workings on the Lander Hill silver mines, at Austin, have been undertaken by H. B. Chessher and F. J. DeLongchamps, of Reno, who purchased the properties from the county.

★ Deep Mines, Inc., a company in which Newmont Mining Corporation is interested, recently cut two narrow streaks of ore in the Florence crosscut of their mine at Goldfield. Some samples from these streaks assayed high in gold, and a raise is being driven along them. The first 10 ft. of raising has disclosed widening ore faces and increasing value.



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ARIZONA

Magma adds substantially to San Manuel tonnage — State studies sales tax levy on subsidies

★ In a report to stockholders covering operations for the first three months of 1947, the management of Magma Copper Co. stated that drilling of the company's San Manuel orebody had added a large additional tonnage of proven ore. Developed tonnage on March 31 was estimated at 354,500,000 tons, of which 235,000,000 tons assaying 0.80% copper is sulphide. This compares with 211,500,000 tons and 127,500,000 tons, respectively, developed at the end of 1946.

Magma Copper Co. had a net profit of $268,234 for the quarter after provision for depreciation, depletion and federal income tax.

★ Mica-mining operations have begun at the Sunshine Mecca mine, near Ajo. Ore will be treated at the Buckeye mill. Walter Toco and R. D. Smith will operate the mine and supervise the milling.

★ A meeting of the Arizona Copper Tariff Board was scheduled to be held during May to discuss methods of maintaining a close watch on the effect of recent legislation suspending the 4¢ per pound import duty on copper until 1949. Sam H. Morris, chairman of the board, termed the recent act of Congress a substantial victory for Arizona and other copper-producing states, and said that if the influx of foreign copper created a curtailment of domestic production, congressional leaders will be immediately asked to protect the home market.

★ The possibility of recovering from State mining corporations an estimated $300,000 in unpaid sales taxes on the federal subsidy granted copper producers for high production is being studied by the Arizona Tax Commission. The federal subsidy, amounting to 5¢ per pound, was authorized by the Government in an effort to stimulate production of metal during the war years.

The issue was raised last year on whether the subsidy was a part of the gross income of copper producers, and, as such, subject to the sales-tax law. The opinion of two members of the former commission, who took the view that the premium money was not taxable, was sustained by a ruling of the Attorney General, which held that the premiums should not be considered in computing the State sales tax. The opinion was based on a ruling by Montana courts that such premiums or subsidies may not be considered in computing the amount of the tax, and that the effect of such payments by the Federal Government is not to increase the value of the metals, since they do not change the market price at which they are bought and sold. Chairman Hunt of the State Tax Commission stated his concurrence after the Attorney General's ruling.

However, Hunt explained, a more recent decision by the Utah Supreme Court, taking a divergent viewpoint from the Montana case, has prompted the commission to reopen the issue of collecting the sales tax on copper subsidy payments.

★ J. S. Coupal reports that ore shipments have started from the Courtland Mining Co., near Courtland. The ore, averaging between 4% and 5% copper, is being sent to the Phelps Dodge smelter at Douglas.

★ A promising body of silver ore is said to have been encountered on the 200-ft. level of the Intervenor mine, which is under development by A. P. Giacoma, of Tombstone. Giacoma has been making intermittent shipments of silver-gold ore from the old tailings dump of the Grand Central mill, in Fairbanks.

★ A group of eight claims at the Western edge of the Vulture mining district has been acquired by Calzona Mining Co. Open-pit methods will be utilized in mining mica on the property. Initial equipment costing about $10,000 is being moved to the operation.

★ State highway engineers, taking soundings for the foundation of a Pinto Creek bridge, near Miami, drilled into an old tunnel estimated to be 400 ft. in length and thought by some to be the entrance to one of the State's fabulous "lost" mines. Further investigation of the old mine was temporarily halted by a cave-in which occurred a few days after the discovery. Specimens indicate gold, copper, turquoise and other minerals.

★ Phoenix agents of the copper-fabricating firm of Lewis-Mathes Co., of St. Louis, Mo., and Monsanto, Ill., announced on May 9 the acquisition of 28 mining claims in the White Mesa area, 25 miles northeast of The Gap, on a lease-and-option basis. Extensive exploration drilling is to start at once on the property, and it is probable that construction of a processing plant and camp facilities to cost an estimated $500,000 will be under way within 90 days. According to Thomas D. Darlington, head of Darlington, Hastings & Thorne, Phoenix industrial consultants, and agents for the St. Louis principals, a large area of the ground acquired will run from 1.25% to 1.50% copper in open-pit mining.

A second development by the same company consists of exploratory drilling operations on a wide scale at the Emerald Isle mine, at Kingman. If developments warrant, an electrolytic plant will be constructed to cost a minimum of $500,000, with a total possible expenditure of $2,000,000.

★ After four days of negotiating, representatives of the Phelps Dodge Corporation and the American Federa-

tion of Labor agreed upon wage increases of 92¢ a day, effective May 6. The announcement was made by J. T. Weir, executive secretary of the District Metal Trade Councils. Terms of the contract with the company have been extended for one year. CIO has not yet accepted the company's invitation to discuss a similar program. The 92¢ increase applied to all Phelps Dodge employees at Jerome, Clarkdale, Morenci, Ajo, Bisbee, and Douglas.

★ Lead concentrates averaging more than $8,000 per 50-ton car are being shipped regularly from the Tennessee mine to the A.S.&R. smelter at El Paso, Tex., according to Thomas L. Chapman, manager for Tennessee Schuylkill Corporation. The company plans to mine and mill 100 tons of ore daily within the next two months. President Nye A. Wimer stated that a considerable portion of the tonnage so far mined has carried combined values of more than $80 per ton in lead and zinc, besides some gold and silver. The vein is said to average from 6 to 15 ft. in width over a length of 450 ft., with a proven vertical depth of 300 ft. Developments at the Tennessee mine have focused the attention of several large mining companies on the district.

CALIFORNIA

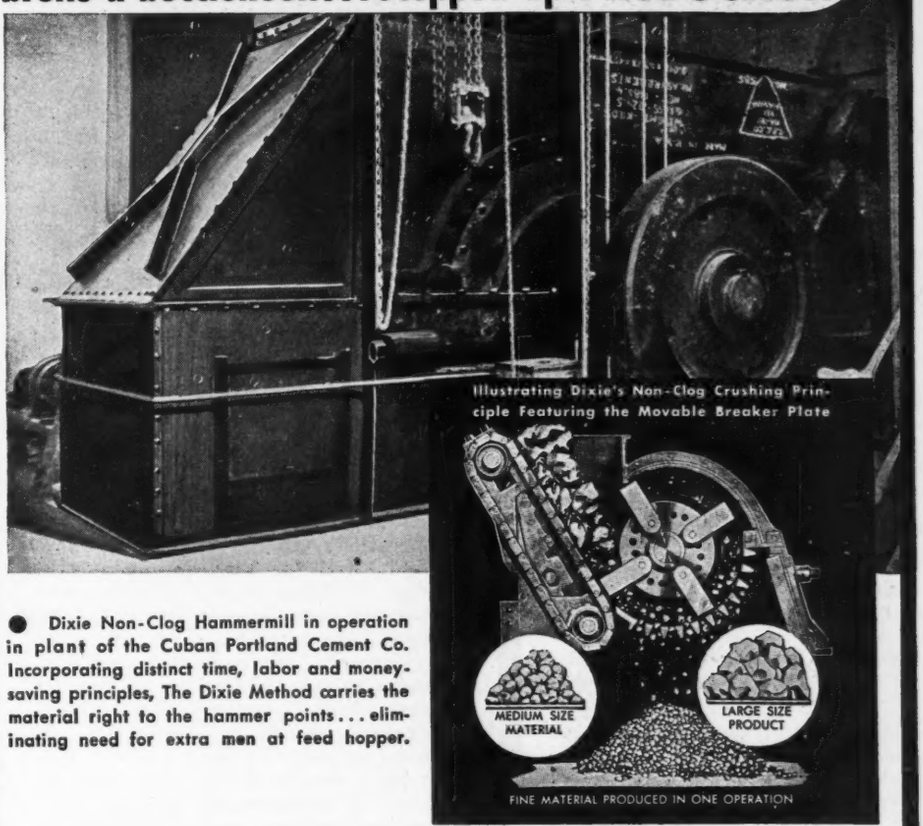
Mountain King steps up milling rate—Natomas Co. reports big earnings increase

★ Rehabilitation work is progressing satisfactorily at the property of Central Eureka Mining Co., at Sutter Creek, Amador County, one of the premier gold producers on the Mother Lode before the wartime shutdown of gold mines. The old Eureka shaft has been retimbered to the 3,500-ft. level, and driving a drift south to the main Central Eureka shaft is in progress. The north drift to the orebody is being repaired preparatory to resumption of mining and production. C. C. Prior is president.

★ Production at the Mountain King mine, near Hobson, Calaveras County, operated by Stewart & Nuss, of Fresno, has been stepped up to more than 500 tons of ore a day following installation of new equipment at the mill. The gold ore is mined by power shovels and trucks from an open pit about ¼ mile from the mill. Thomas B. Rice is superintendent, and 30 men are employed.

★ According to a press release from the Division of Mines, Olaf P. Jenkins, State Mineralogist, iron ore shipped from the State during 1946 totaled 428,354 net tons, valued at $1,061,956 f.o.b. mine. Production came from two mines in San Bernardino County and one each in Los Angeles, River-

How the CUBAN PORTLAND CEMENT CO. broke a bottleneck...stepped up PRODUCTION


Illustrating Dixie's Non-Clog Crushing Principle Featuring the Movable Breaker Plate
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● Dixie Non-Clog Hammermill in operation in plant of the Cuban Portland Cement Co. Incorporating distinct time, labor and money-saving principles, The Dixie Method carries the material right to the hammer points... eliminating need for extra men at feed hopper.

Down in the bay of Mariel, some 20 miles out of Havana City, the semi-tropical climate accounts for 50 to 70 inches of rainfall per year. For the Cuban Portland Cement Co., this factor ... combined with the soft, wet material generally encountered in quarrying operations ... was seriously curtailing production.

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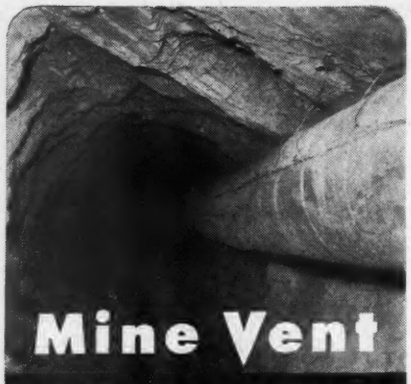

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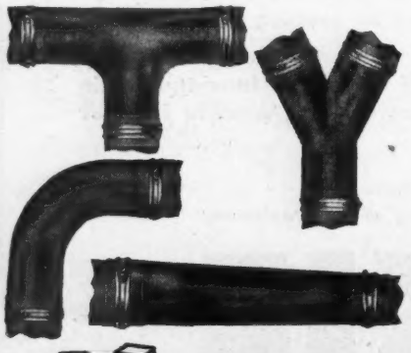


AMERICAN
BRATTICE CLOTH CORP.
WARSAW, INDIANA

California *(Continued)*

side, and Shasta counties. These figures show an increase in amount and value over those of 1945, totaling 240,917 net tons, valued at $883,434. The ore mined in San Bernardino and Riverside counties was hematite, most of it going to the Kaiser steel plant at Fontana. A part was used in the manufacture of high-iron cement, and as foundry flux. Magnetite from Shasta County was used as aggregate in heavy concrete for ballast, and the Los Angeles County magnetite sands were utilized in the manufacture of roofing.

★ E. L. Oliver, president of Idaho Maryland Mines Corporation, in a review of conditions at the company's gold properties at Grass Valley, Nevada County, expressed satisfaction with current progress in rehabilitating the mines and expects the company to pay a token dividend in 1947, probably 10¢ a share. He stated that the management considers the outlook for the future to be promising, and operations are expected to attain a profit level for 1947 despite current wage levels and high materials and supplies costs. Contributing to this result are installations of improved equipment, better mining methods, and a system of incentive or contract work which gives the miners a higher income based on ore production per man. Capacity of the Brunswick mill is being increased 50%, and improvements in metallurgical practice have reduced milling costs and tailings losses. The company has also installed a sawmill, which furnishes timber for the mines and produces earnings from outside sales. Labor conditions have shown great improvement, and 450 men are now employed. Extension of the orebody from the 2,400 level to the 2,700 level in the Idaho mine was proved during 1946. Neil A. O'Donnell, executive vice president and general manager, is in charge of operations.

★ Diamond drill work is in progress at the Liberty gold mine, near Alleghany, Sierra County, controlled by J. A. Hassell and associates. Extensive development is planned if drilling discloses commercial ore.

★ Golden Feather Dredging Co., E. A. Wiltsee, president, has moved its dragline dredge from the property near Auburn, Placer County, to a new site of operations near French Corral, in Nevada County. The company has recently secured leases on holdings along the ancient gravel channel between Esperance ground at French Corral and the Kate Hayes pit at Birchville, near North San Juan Ridge.

★ Natomas Co., Thomas McCormack, president, reports total profit for 1946, before income tax, of $1,318,084, compared with $67,115 for 1945. The company is now operating its entire fleet of seven dredges in the Folsom area.

★ The Mudd interests, including Harvey S. Mudd, Seely G. Mudd, Henry T. Mudd, and George V. Dub, are reported to be the new owners of the Western borax mine, at Boron. Sale of the property was recently disclosed by R. E. Allen, receiver in the matter of the United States vs. Borax Consolidated. The purchase price was said to be $500,000, subject to court approval.

WASHINGTON

Consider reopening Red Mountain copper mine—Sink-Float plant to treat Electric Point ore

★ Big Lake Mining Co., whose property is southwest of Kettle Falls, held its annual meeting in Spokane in April, and elected John J. Stalick, Will Everett, Fred Colwell, Knute Hill, and Erwin C. Yake directors. Added drilling operations are planned for the summer.

★ Royal Exploration Co. is considering reopening the Red Mountain mine, a copper property north of Leavenworth. The company has optioned 111 claims and six millsites for $20,000, covering the pipe lines from Phelps and James creeks, and the mine and buildings at Trinity. The new company is said to be made up of former shareholders of Royal Development Co.

★ Associated Piping & Engineering Co., which is building a Sink-Float plant at the Electric Point mine, in northern Stevens County, expects to have it in operation early this summer, according to Walter J. Nicholls, former head of the mining bureau of the Spokane Chamber of Commerce. He says it is a new type of concentrator, built like a prefabricated house. Capacity will be 100 tons per day. The Associated company will operate the plant.

★ Congressman Walt Horan, in discussing the WAA's refusal to honor bids for the sale of the magnesium plant at Mead, asserted that the plant is a potential source of wealth and could provide employment for hundreds of persons. Horan said, "WAA chiefs stated there was not sufficient electrical energy available to run the plant and reasoned that a company cannot pay for the plant if it cannot operate it."

★ According to the Bonneville power administration office, at Portland, Ore., Kaiser's Mead aluminum reductior plant is limited by power shortage to operation of five potlines in place of the six scheduled at this time. "The power situation in the Northwest is such that it is believed that, without further commitments, there will be barely enough power available to carry the estimated loads through next winter," a statement from the Bonneville office explained.

IDAHO

Silverton Mining Co. develops property — Consolidation of Day interest is proposed

★ The directors of Hecla Mining Co. have proposed a retirement plan for employees who have five years or more of service to their credit. The payments provided would be retroactive to Jan. 1, 1947, and would affect all employees of the Hecla, Polaris, Star, and Rock Creek companies. It is estimated the cost of the proposed plan will amount to $634,287 for past benefits and $40,000 for the current year. Retirement age will be 65.

★ The annual report of Monitor Mining Co. for 1946 shows a loss of $153,567 after deducting $207,758 for depletion and depreciation. During 1946, five mines, the Amazon, Carlisle, Mipsic, Silver Tip, and Parrot, produced 59,100 tons of ore which averaged 0.97 oz. silver, 2.21% lead, and 6.16% zinc per ton. Since 1942 the company has produced 262,617 oz. of silver, 12,681,028 lb. of lead, and 31,318,226 lb. of zinc. All the ore delivered through the Carlisle tunnel is milled at the company's own plant on Beaver creek, and other ores have been treated at the Hercules and Dayrock mills, in Wallace.

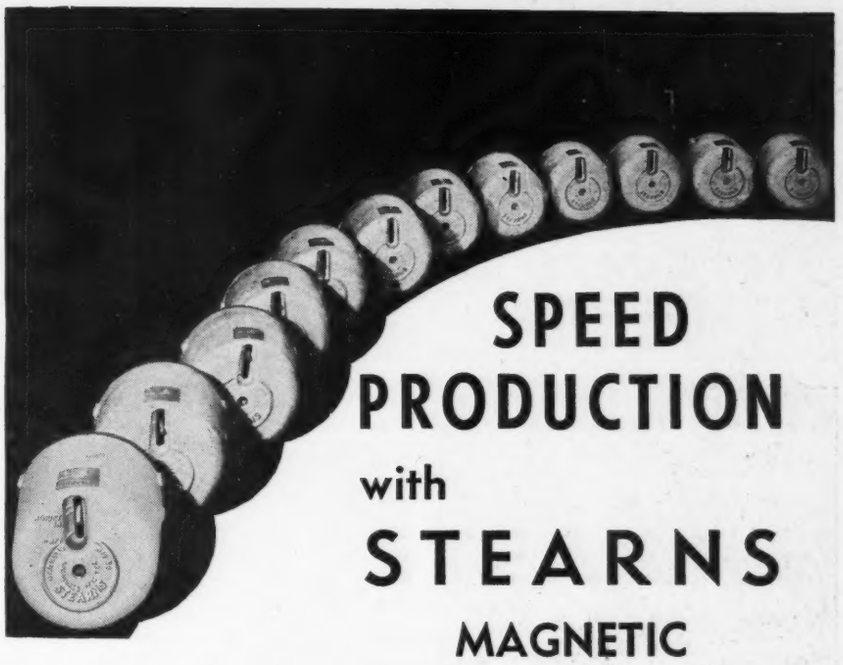
The company recently purchased the old Interstate-Callahan zinc mine from the Callahan Zinc-Lead Co., and has connected the lower workings of this mine with the Beaver Creek operations by 1,800 ft. of new tunnel work.

Correction

★ On page 134 of the April 1947 issue reference was made to a preliminary report released by the U. S. Geological Survey covering investigations of phosphate-vanadium beds in Idaho, Wyoming, and Utah. It was stated that the report had "a possible bearing on atomic energy development." The quoted phrase was an expression of opinion on the part of the writer of the news item, based on the frequent association of uranium with vanadium minerals, and should not be attributed to the U. S. Geological Survey. We are informed that no reference to atomic energy development is contained in the U.S.G.S. report.

★ Dayrock Mining Co. reports a net profit of $104,060.23 for 1946, after deducting depletion, depreciation, and federal taxes. During the year the company developed a major-sized body of silver-lead ore on the 650 and 800 levels.

★ Sunshine Mining Co. has collected $352,000 from insurance companies in full payment for damages sustained in an underground mine fire. Polaris



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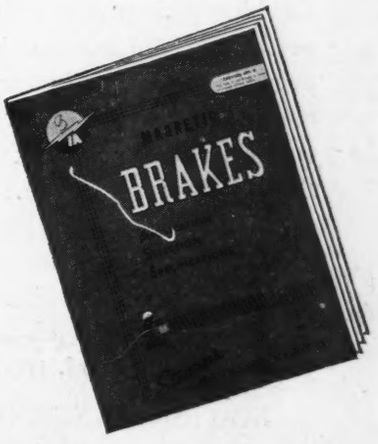

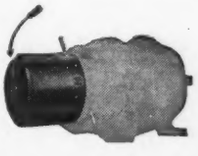

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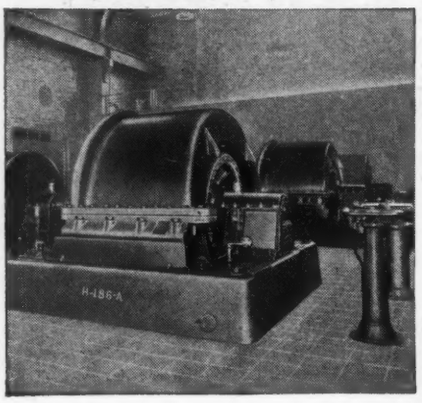

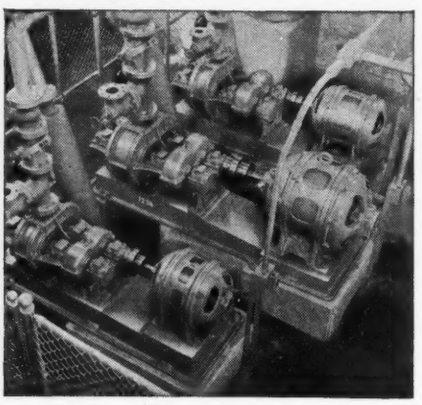

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Idaho *(continued)*

Mining Co., which suffered losses in the same fire and was similarly protected, collected $387,000.

★ Silver Bowl Mining Co. has shipped 600 tons of ore to the Golconda mill from a recent strike in the old Stewart mine, at Kellogg. The resulting lead concentrates averaged 76% lead; the zinc concentrates ran 52% zinc and 26 oz. silver per ton.

★ Net earnings of the Highland-Surprise mine, on Pine Creek, have amounted to $43,256 for the first four months of 1947, before deductions. The company has recently installed a new Coeur d'Alene 200-hp. electric hoist preparatory to sinking from the 800 to the 1,000 level. It is custom-milling 100 tons of ore per month for the Nevada-Stewart company.

★ The Sunshine Consolidated Co., operating through the 3,100 level of the Sunshine mine, has followed a rich streak of ore some 18 in. wide for a distance of over 1,000 ft. Mined for the full width of the drift, the material has milled at the rate of 23 oz. silver per ton. Recently assays on the clean ore gave values of from 800 to 1,000 oz. silver per ton.

★ Bunker Hill & Sullivan Mining & Concentrating Co. has declared its second dividend for 1947, totaling 25¢ a share, or $327,000. The company's annual report for 1947 shows a net income of $1,277,499.69 for 1946. President Stanly A. Easton reports that labor shortage reduced the mine output to 9,839 tons of lead, 673,330 oz. of silver, and 2,904 tons of zinc, and estimated the ore reserves in sight at 2,023,829 tons of lead-silver-zinc ore and 562,632 tons of zinc-lead-silver ore, or a total of 2,586,461 tons.

★ Silverton Mining Co. is conducting a development in Revenue Gulch north and west of Wallace. After diamond drilling, the company recently started a deep-shaft development which has been completed to a depth of 460 ft. The vein system will be prospected at this horizon before going to deeper levels. The property is modernly equipped. Glen L. Fish, J. H. Hansen, Jr, V. A. Finrow, W. L. Henderson, Thomas Young, E. Roecks, and George Jull, all of Spokane, are directors, with W. L. Henderson acting as general manager.

★ Polaris Mining Co.'s Silver Summit crosscut from the 3,000 level is being advanced at the rate of about 20 ft. per day, according to George Grismer, superintendent. The operation will crosscut the entire silver belt.

★ Callahan Zinc-Lead Co. report for 1946 shows a net profit of $186,104.63, with $185,000 set aside as addition to contingency reserves. The company's Deadwood mine, in Valley County, was closed and leased to independent operators. The Mount Hope mine, in Nevada, increased its production over that for 1945.

★ Henry L. Day, manager of the Day Mining interests in the Coeur d'Alene district, has announced that his companies are considering a consolidation of all the Day properties under one non-assessable corporation to be known as Day Mines, Inc. The merger would include three dividend-paying mines, the Tamarack & Custer Consolidated, Sherman Lead, and Dayrock.

"The prospective value of the consolidated enterprise is very substantial," Day said, "and the known ore reserves contain substantial quantities of lead, zinc, silver, and gold. Earnings would be stabilized and the financial position of the new corporation will be relatively sounder than that of any of the present companies."

The proposal is to be submitted to a vote of all Day company stockholders.

★ Since inauguration of the Premium Price Plan and up to the end of 1946 mining companies and leasers have produced and processed approximately 5,606,000 tons of zinc-lead ore from waste river tailings and old mine dumps in the Coeur d'Alene district, according to W. L. Zeigler, mill superintendent for Hecla Mining Co., which has treated 3,000,000 tons of river tailings at its Osburn plant. Mineral values recovered in all district operations of this nature total 5,090,000 oz. silver, 86,988 tons of lead, and 77,678 tons of zinc.

MONTANA

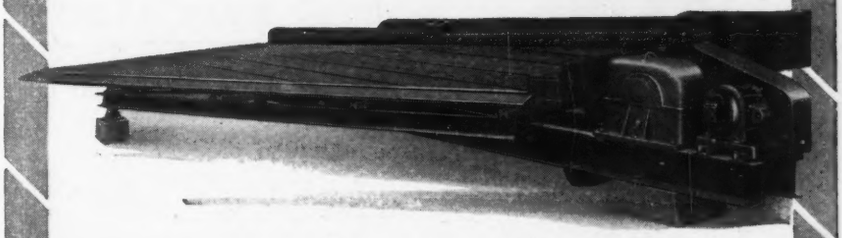
Mining Association announces plans for summer meeting

★ At the ninth summer meeting of the Mining Association of Montana, to be held at the Hotel Finlen, in Butte, on Aug. 3 and 4, R. W. Diamond, of Trail, B. C., vice president and general manager of Consolidated Mining & Smelting Co. of Canada, will address the convention on "The Trend of Things, and Our Responsibilities." Evan Just, of New York City, editor of *Engineering and Mining Journal*, will speak on "High Lights on the Mining Outlook." During the meeting there will be a joint luncheon of the members of the association and of the Montana, Coeur d'Alene, and Columbia sections of the American Institute of Mining & Metallurgical Engineers, at which William A. O'Kelly, of Butte, chairman of the Montana section and chief mining engineer of the Anaconda Copper Mining Co., will preside.

★ Norman B. Holter, of Helena, mining engineer, banker, and businessman, was the principal speaker at a meeting of the Last Chance Gulch Mining Association, Helena chapter of the Mining Association of Montana, on April 17. Holter gave a history of the early days of mining in Montana.

★ Hecla Mining Co. has purchased the Blacktail mine, a newly discovered

SuperDuty Offers Utmost Separating Efficiency



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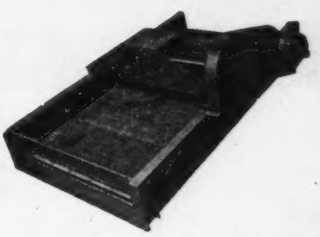

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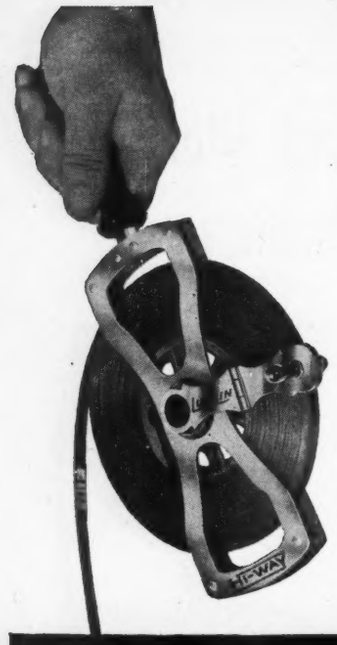

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LUFKIN FOR ACCURACY

Montana (*Continued*)

silver-lead property about 30 miles southeast of Missoula. Hecla engineers describe the property as a "good prospect." A program of development has started and a trial carload of ore will be shipped to the company's mill at Gem, Idaho, according to L. E. Hanley, president and manager.

COLORADO

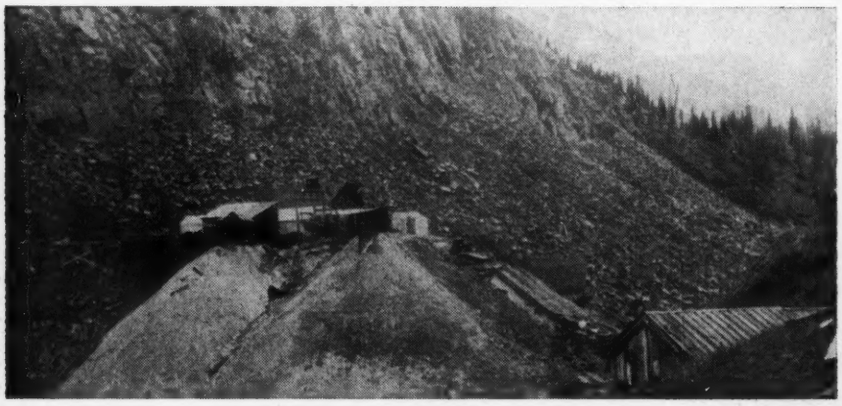
Feldspar companies put up new mills — American Zinc's Kohler tunnel to produce soon

★ Gold mining in the Rocky Mountain district is making gains after the wartime shutdown. Moses Smith, superintendent of the Denver mint, reports that receipts of gold showed a rise in March, when a total of 50,253 oz. of gold was received, valued at $1,758,870. This compared with 26,069 oz., worth $912,434, in March 1946. Silver receipts totaled 13,355 oz., worth $11,989, compared with 8,686 oz. a year ago, valued at $6,172.

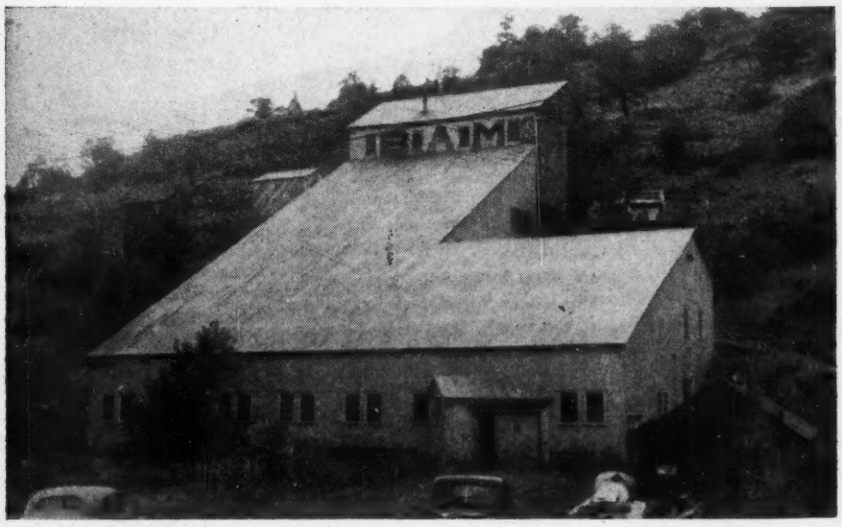
★ Twenty-two foreign countries are represented in the 1946-47 enrollment at the Colorado School of Mines. The largest number of foreign students come from India, China, and Turkey, with Brazil, France, Germany, Norway, Mexico, Sweden, Bolivia, Canada, Peru, Newfoundland, Siam, Belgium, The Netherlands, Cuba, Ecuador, Colombia, Venezuela, and South Africa represented.

★ Feldspar mining is expanding. At Parkdale, near Canon City, Consolidated Feldspar is building a $500,000 flotation mill which will start production this year. Across the river another new flotation mill is being constructed by Eicheim Lead Zinc Co.

★ General Chemical Co. continues to be one of the two main producers of fluorspar in the Jamestown district of Boulder County. The production rate varied from 80 to 100 tons daily during 1946. W. A. Pope is mine superintendent, and 20 men are employed.



KOHLER TUNNEL, at Red Mountain Pass, Colorado, is under option to the American Zinc, Lead & Smelting Co., which is expanding operations in the area. *E.&M.J.* Staff Photo.



NEWLY ACQUIRED CUSTOM MILL of the American Zinc, Lead & Smelting Co. near Ouray, Colo., is being overhauled and modernized to 250-ton capacity by the Denver Equipment Co. John Bowsher is local manager in charge of operations in the district, which include lease and option holdings of the Batchelor Consolidated, Portland Group, Kohler Tunnel, and the Congress Group. *E.&M.J.* Staff Photo.

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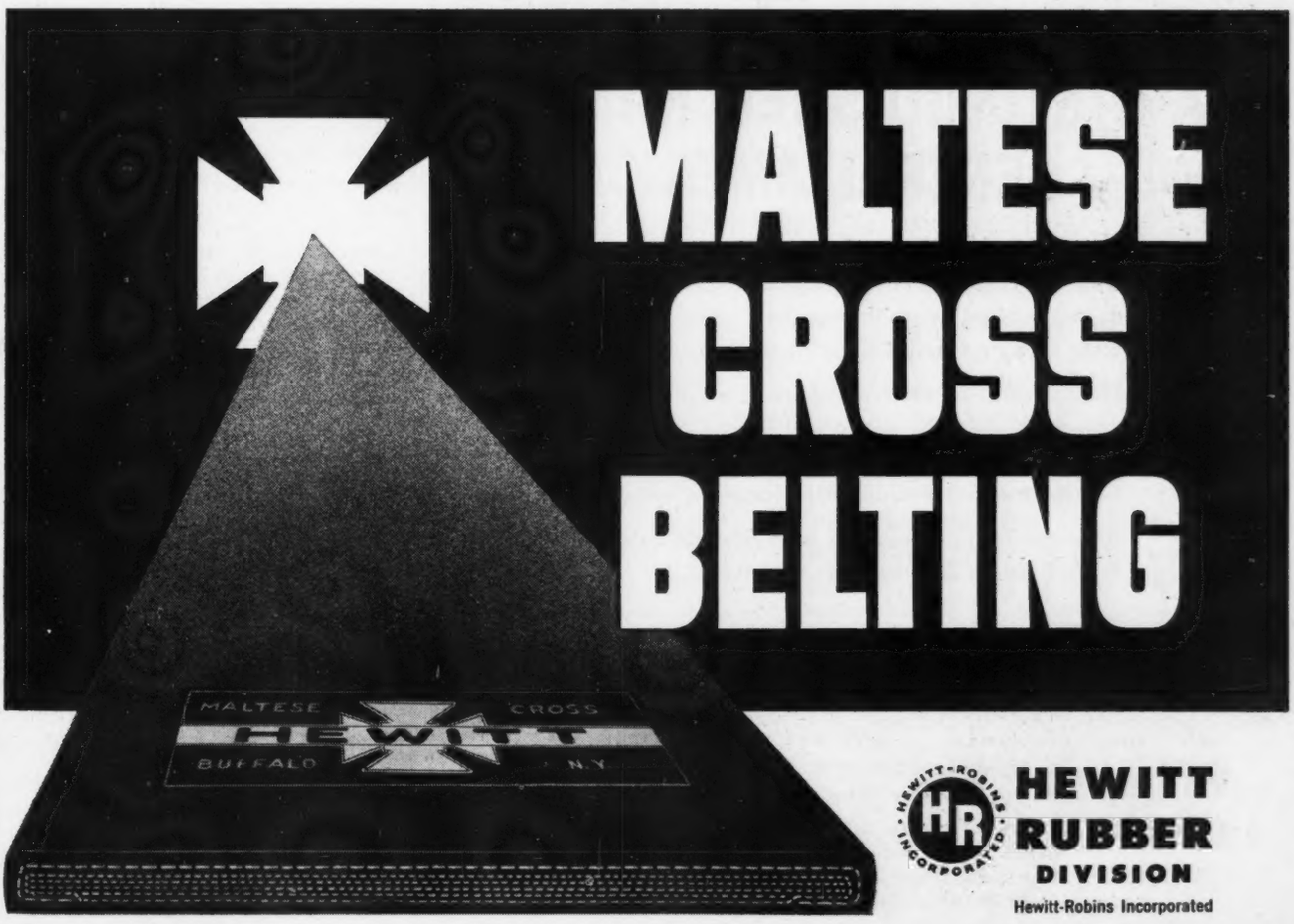

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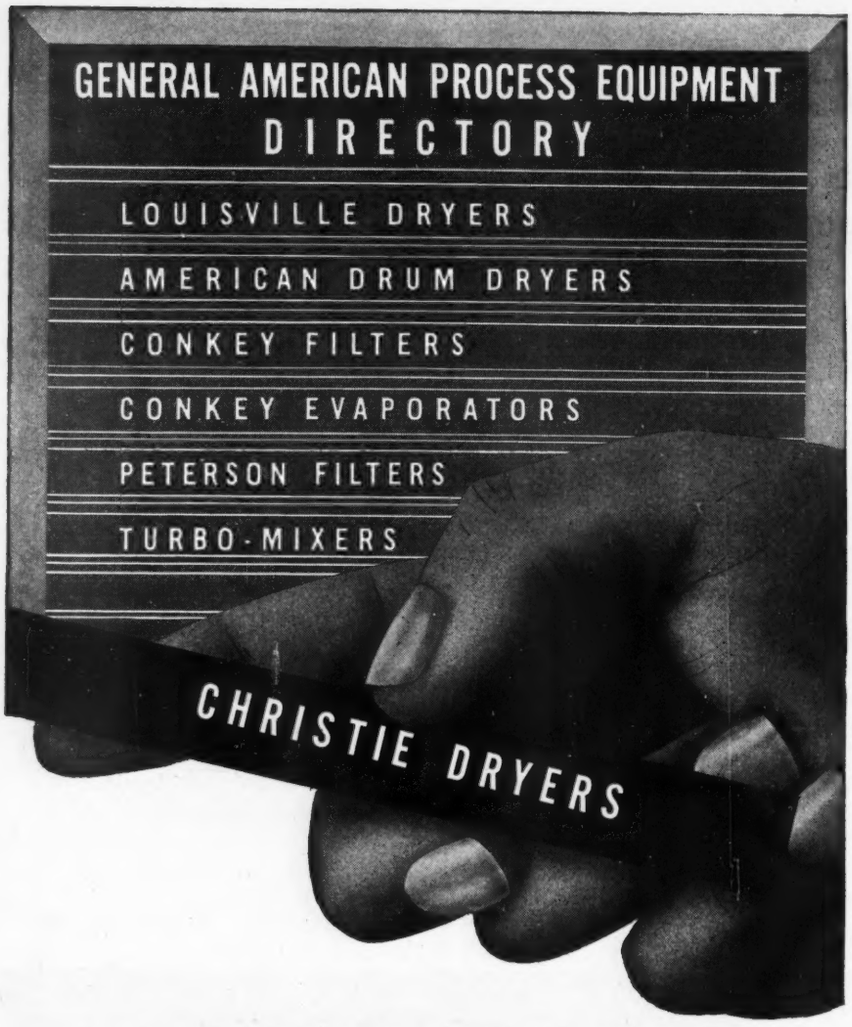

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GAT X GENERAL AMERICAN

Colorado (*Continued*)

The U. S. Bureau of Mines has been pursuing an extensive drilling program on General Chemical property to determine the possible depth of the Jamestown oreshoots.

★ Resurrection Mining Co., of Leadville, recently declared a $150,000 dividend. The company is owned in equal shares by Hecla Mining Co., Newmont Mining Corporation, and United States Smelting, Refining & Mining Co. Full production was not attained in 1946, but a profit of $175,051 was reported after depreciation, depletion, and taxes. The company produced and milled 65,000 tons of lead-zinc ore and in addition milled over 35,000 tons of custom ore in its mill in California Gulch. M. E. Newlove, general manager, says the search for new orebodies will be widened this year.

★ L. C. Burman, of New York City, chief of the licensing branch of the Atomic Energy Commission, was recently in Utah and Colorado to discuss with prospective uranium producers the regulations which have been formulated and adopted by the commission governing the licensing of the production and disposal of uranium-bearing ores and materials, and to receive applications for such licenses. With the issuance of these licenses it is expected that the mining of carnotite ores will be resumed throughout southeastern Utah and western Colorado. Announcement was made by representatives of the Vanadium Corporation of America that this company is now in the market for carnotite ores, and will pay for both uranium and vanadium content. Heretofore producers have been paid only for the vanadium content of ores.

★ Heirs of Joseph Sykes have granted a five-year lease and option to purchase on the Ophir lead mine, near Alma, in Park County. M. J. Krolicki is the lessee. The lessee plans to employ machinery in mining and to truck the lead to the Leadville smelter after concentration in the Record custom mill.

★ Henna Mines, Inc., has completely reequipped the Cash mine in Boulder County, having installed an electric hoist, a tugger hoist for underground use, electric pumping equipment, blacksmithing tools, a headframe, ore bins, and compressors with capacity for ten rock drills. The shaft has been retimbered to the tunnel, or 130-ft., level, and the tunnel has been cleaned and retimbered.

★ The most extensive tungsten development in Boulder County is by Firth-Sterling Steel & Carbide Corporation at the new Wolf Tongue tunnel. The company has been prospecting the various veins of Hurricane Hill exposed in a crosscut completed in the spring of 1946. A drift is now being driven on one of these veins and enough low-grade ore is recovered to keep the mill going one shift a day.

★ New installations in the mill of American Zinc, Lead & Smelting Co., north of Ouray, to raise the capacity of the plant to 250 tons daily, are expected to be in place soon. When completed this will be one of the most modern mills in the West. The installations were designed after a careful study of the complex ores of the region in the laboratories of the Denver Equipment Co.

★ Natomas Co., of Sacramento, Calif., owner of 50% of the preferred stock of South Platte Dredging Co., at Fairplay, received half the dividend of $180,000 declared by South Platte on earnings from gold placer operations. Dredge production for the year ended Nov. 30, 1946, totaled 4,890,721 cu. yd. The return was at the rate of 1.025¢ per curbic yard.

★ High gold and silver asays were reported on a recent shipment of ore from the Idaho mine, north of Hesperus, near Durango. DeLuche Brothers, who lease the property from A. B. Crosby, of San Antonio, Tex., said the shipment ran $930 a ton in gold and $31 in silver. The smelter return prompted resumption of milling operations at the Idaho.

★ Marvin Kay, manager of American Zinc, Lead & Smelting Co. operations at Ouray, reports that production from the company's Kohler tunnel will be starting soon. The work of getting into the ore has been completed and stoping begun. The company is also doing a large amount of exploration and development work at the Portland property, and good progress is being made, according to K. G. Link, superintendent.

★ International Mining Corporation, in its annual report for 1946, records the ownership of 13,125 shares, or 25.74%, of the capital stock of El Paso Mines, Inc., of Cripple Creek. Referring to operations at this property, the report says: "Development during 1947 will have as its objective the search for and opening up of minable ore in the extensions of known orebodies into the virgin areas of the property above the bottom level and at the intersections of veins and dikes in depth. Additional financing will be required for this work, and El Paso Mines, Inc., plans to raise $204,000 by the sale of shares and interest-bearing notes, of which your corporation proposes to take its proportion. A total of 380.89 tons of ore assaying 0.345 oz. gold per ton was shipped in December. This ore came mainly from development work and represents large-scale sampling rather than productive efforts.

★ The annual report of Golden Cycle Corporation indicates that the company is not anxious to mine its Ajax orebody under present condition of scarce labor and high costs. The corporation officers have expressed the belief that gold will ultimately sell at a higher price and that rich ore on the Ajax 27th level now being de-

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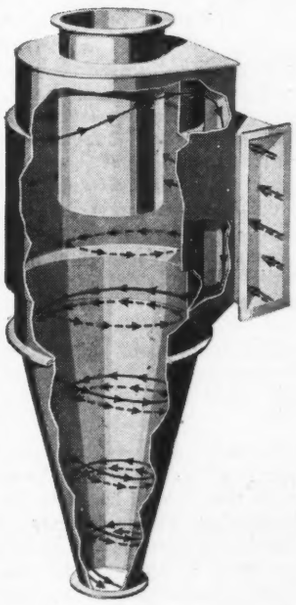

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Colorado (*Continued*)

veloped can eventually add greatly to company earnings. Golden Cycle showed improved earnings in 1946. Net income totaled $20,252, compared with net loss in 1945 of $19,702. Cost of labor and materials is running from 35% to 40% more than in 1940, the report said.

★ Shenandoah-Dives Mining Co., at Silverton, has released its report for the year ended Dec. 31, 1946. Concentrate sales, including premiums, totaled $907,216, compared with $831,664 in 1945. Net income for the year totaled $54,524, compared with $16,520 in 1945. Charles A. Chase, vice president and general manager, summarized 1946 operations as follows: "Mill tonnage rose to the highest level since 1941. The ore was much poorer than in 1945, but higher premium prices compensated importantly. Metallurgical recoveries gained percentage-wise, this despite poorer grade and impairment by oxidation, a noteworthy result."

★ The expansion program of Callahan Zinc Lead Co., at Whitepine, near Gunnison, is accelerating. A new bunk house is to be completed at the mine this spring to accommodate 24 men. A new ore bin is under construction at the Erie mine. Plans are well under way for construction of a mill.

NEW MEXICO

Silver Hill mine develops new orebody — Potash industry concerned over lease regulations

★ Banner Mining Co., operating the Bonney mine and the adjoining Miser's Chest property, 6½ miles south of Lordsburg, in the Virginia mining district, reports considerable exploration and development work in progress in the Miser's Chest mine. Copper concentrates are produced in the mill on the property. Mine development is being carried on by diamond drilling, shaft sinking, drifting, and crosscutting. The first stage of the exploration program will be completed about July 1, when the Bonney and Miser's Chest mine connect on the 900-ft. level. Provided operating conditions do not become more adverse, this low-grade copper operation will become a substantial producer.

★ A. V. dePascale, owner and operator of the Silver Hill mine, 6½ miles from Silver City, in the Pinos Altos district, reports developing under a cap of monzonite and porphyry what appears to be, at a depth of 100 ft., the outcrop of a lode or oreshoot with a potential width of 40 ft. The ore is said to carry values in lead of 18% to 30%, zinc 20% to 26%, silver 3 oz. to 19 oz., and some gold. Stringers up to 4 in. wide, 1 to 3 ft. apart, are said to occur across the orebody.

★ The New Mexico potash industry is concerned about the recent amendments to the Bureau of Land Management's regulations regarding the prospecting for and mining of potash on the public domain and Government's "right to purchase" policy. The industry's objections, aired in hearings at Albuquerque in September, 1946, were only slightly tempered by the amendments. Allowable of 15,360 acres for any individual or corporation under permits or leases for exploration purposes was considered inadequate by the industry. The permit limitation for prospecting was raised to a maximum of 25,600 acres, but the limitation of acreage to be held under lease for development and extraction remains at 15,360. The stipulation that the Federal Government has the right to buy 25% of the potash produced at market price was amended to require the lessees to sell to the Department of the Interior, upon a year's advance notice, 10% of their potash output at a price determined by the Secretary of the Interior.

★ The Linchburg mine is being operated under lease from Empire Zinc Co. by C. S. Elayer, W. R. Jenks, and H. A. Kessey. This property, located at 8,000 ft. elevation 5 miles southeast of Magdalena, is producing an average of 2,000 tons of lead-zinc ore per month, which is shipped to the Empire Zinc mill, at Hanover.

Other current producers in the Magdalena district are the Nitt mine, operated by John McDonald, and the Waldo mine of American Smelting & Refining Co. Production from the latter property is treated at the company's mill. Lead and zinc concentrates are made by selective flotation.

TEXAS

El Paso smelter to recover zinc from slags—Lone Star Steel will operate Daingerfield plant

★ A new unit for the recovery of zinc accumulated in lead slag dumps is being added to the El Paso smelter of American Smelting & Refining Co. Contracts have been let and equipment has been ordered for the plant, which is scheduled for completion in the spring of 1948. The process to be used entails remelting the slag in a blast furnace and blowing in powdered coal and air. The zinc is removed as zinc oxide fume, which is caught in woolen bag filters and shipped to A.S.&R.'s Amarillo smelter for reduction to zinc metal. The bag house will be 50 ft. wide and 350 ft. long. A building 150 ft. long and 100 ft. wide will house the blast furnace. A crew of 50 men will be required to operate the new plant, in addition to the 750 men now employed at the smelter.

★ Arrangements are being completed for the Lone Star Steel Co. to start

operating the Daingerfield plant at an early date. The Government-owned plant has a capacity of 1,200 tons of pig iron daily, but will operate on a basis of 750 to 800 tons a day at the outset because part of the property is being used for a Navy experiment, according to Dr. George H. Anderson, vice president.

Lone Star Steel Co. has raised $1,500,000 through stock sales and cash advances for products, and has an agreement to borrow a like amount from Reconstruction Finance Corporation. The $3,000,000 working capital will be supplemented by further sales of stock, Dr. Anderson declared.

The company has a three-year lease on the $30,000,000 plant and some Government-owned coal mines at McAlester and McCurtain, Okla. The minimum rental is $160,000 a year, the actual charge to be based upon the amount of coal, coke, and pig iron used. Lone Star Steel Co. may purchase the property for $7,500,000 any time within the next two years.

★ The construction of a $2,000,000 sulphur mining plant for Texas Gulf Sulphur Co. is under way at Wallisville near Liberty. The new plant, which officials say will be the most modern of its kind in the world, is strategically located for the shipment of sulphur to industries along the coast of the Gulf of Mexico. A barge channel, 7 miles long, is now being completed by United States engineers at Wallisville to connect with the intracoastal canal which joins the Trinity River and provides through shipping facilities to the Gulf.

TRI-STATE

Union requests district-wide wage conference — Mattes mine reopened by leasers

★ The Tri-State zinc-lead mining industry is awaiting with concern the outcome of debate on the Russell bill embodying legislation so necessary to sustain the operations of marginal producers and maintain the present rate of production. Discontinuance of the Premium Price Plan would mean the loss of $50 to $60 a ton in the average price of zinc concentrates to the producer and probably a general shutdown to readjust operations.

★ The policy committee of Tri-State locals of the International Union of Mine, Mill and Smelter Workers, CIO, announced on May 14 that 30-day notice was being given on that date to the Labor Department that a work stoppage may occur with the possibility of a general strike tie-up in the district mining field the middle of June. Howard Lee, regional director of the union, said strike notice was voted as a result of failure of some 24 major Tri-State mining companies to respond to a request sent out on

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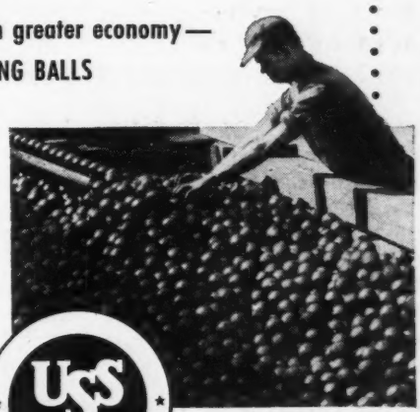

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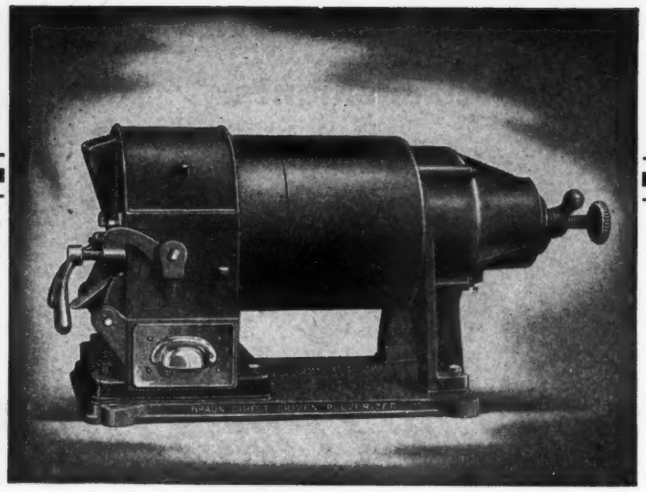

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Tri-State *(Continued)*

April 30 by the union for a joint conference on May 20 to discuss renegotiation of basic wage rates. The union has indicated it desires to renegotiate wages to include substantial increases prior to expiration of existing contracts on June 30, contending that provision for such negotiations is contained in the contracts. Lee said many of the companies have ignored the request for a joint conference while other operators have expressed a willingness to negotiate individually, but not collectively. Declaring that it is virtually a physical impossibility to renegotiate all the contracts separately within a reasonable length of time, and asserting that there are enough common economic problems involved to justify a joint conference, Lee said the union has taken the operator's attitude to be one of evasion. In authorizing the work stoppage notice it was pointed out that this was in compliance with the Smith-Connolly Act. Union officials said that if the strike comes it will involve between 4,000 and 5,000 union miners in the field.

★ H. A. (Dixie) Williams and Gilbert Fenix, of Oronogo, have taken a lease on the old Mattes mine from George W. Potter, of Joplin, owner of the Wildwood ranch, on which the mining property is situated. The mine shaft has been unwatered to a depth of about 160 ft., where clean-up operations will be initiated. The old shaft has been repaired and a derrick erected with necessary hoisting equipment installed for dumping on the surface. Ore will be trucked to the C., G. & C. Northside mill, northwest of Chitwood. Plans have been made to do the clean-up with a diesel-powered bulldozer, and to load with a mechanical shovel operated by compressed air. Potter recently acquired the entire Missouri holdings of the C., G. & C. company, which operates a tailing plant and mines in Oklahoma. Charles A. Neal, Sr., and G. C. Niday, both of Miami, have retained their interests with Potter in the Oklahoma properties.

ARKANSAS

New operation at Little Rock produces roofing granules

★ Minnesota Mining & Manufacturing Co. will produce about 200,000 tons a year of colored roofing granules from a $3,000,000 plant which went into operation at Little Rock on April 24. Raw material for the plant is obtained from a large deposit of syenite on nearby Granite Mountain, which prolonged testing, begun in 1938, proved to be a suitable base mineral for roofing granules. The broken material is hauled in 15-ton trucks to a

crushing plant, where three-stage crushing and conveying reduces the rock to ¾-in. size. The processing plant, which employs 150 workers, is already producing about 500 tons daily. The granules are sold to asphalt roofing manufacturers.

ILLINOIS and KENTUCKY

American Zinc & Lead will drill Kentucky acreage — Alco builds mill at Patrick lead mine

★ American Zinc & Lead Smelting Co. has leased approximately 4,000 acres in Crittenden County, Ky., northeast of Marion, and plans to start drilling operations in June. Practically no mining has been done on the properties. Philip Emrath will be in charge of drilling.

★ The Government-owned Corod plant, at Marion, Ky., constructed during the war for differential flotation of zinc, lead, and fluorspar, has been purchased by Alco Lead Corporation, of Evansville, Ind., the highest bidder, for $36,000. The mill was completed in 1943 at a cost of $252,000. Several plans for disposition of the equipment are being considered by Alco Lead, among them removal to the company's new mill now under construction at its lead mine in Hardin County, Ill., or removal of part of the equipment to the Illinois mine and part to the Senate mine, near Princeton, Ky., under an arrangement with Minerals Flotation Corporation. The Corod property embraces about 31 acres of land, a mill building with floor area of 11,000 sq. ft., flotation machinery, a laboratory, and an office building.

★ The old Patrick lead mine, 4 miles south of Peters Creek in Hardin County, Ill., has the distinction of being the only mine in the Kentucky-Illinois district mining lead exclusively as well as the only open-pit operation. It has been operated by Alco Lead Corporation, of Evansville, Ind., since 1942. Kenneth Ingle, of Evansville, is president, and Philip Emrath, works manager.

Two draglines, of 3½-cu. yd. and ½-cu. yd. capacity, respectively, are in use. Up to now the ore has been hauled to the company's mill at the site of the old Benzon fluorspar mine, but construction of a new mill at the mine has been started. A Heavy-Media separation plant will be installed. The washing unit and other usable machinery and equipment will be transferred from the old to the new plant.

In years past the mine has been the site of several shaft ventures, but was abandoned for long periods.

★ A charter of incorporation recently was granted International Silica Co.,

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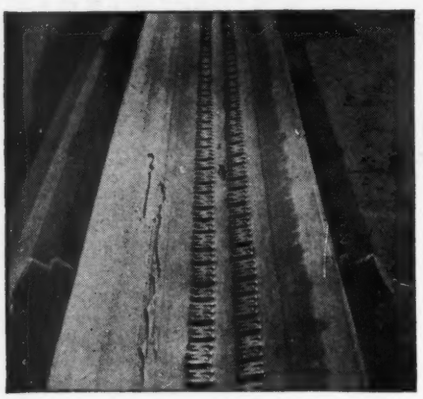

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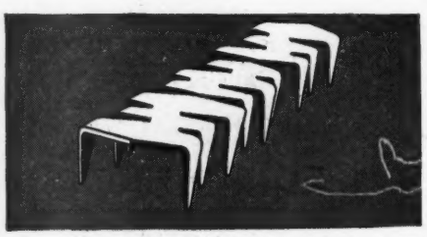

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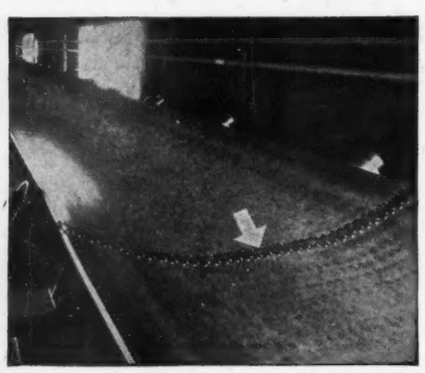

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(continued)

of Marion, Ky., with authorized capital stock of $80,000. Officers of the company are Dr. R. W. Robertson, of Paducah, Ky., president; W. H. Robertson, of Paducah, secretary-treasurer; and T. J. Pate, of Marion, vice president and general manager. The company has completed core drilling on its property and approximately 30,000,000 tons of high-grade silica sand are proven. A sand-processing plant with a capacity of 50 tons per hour is being erected. The company expects to be in production by July 15, making glass and foundry sands and some finer products.

★ The Bonanza Fluorspar mine, 1½ miles west of Lola, in Livingston County, Ky., has been leased to L. F. Hearne by Paul Cullum, of Frankfort, Ind. Sinking of a new shaft is in progress. Hearne, former owner and operator of Eagle Fluorspar Co., sold all the company's properties, including the Babb, Watson, and Cullen mines, to Aluminum Ore Co. several months ago.

★ Kentucky Fluospar Co., of Marion, has purchased a Western-Knapp Mobil Mill, Heavy-Media separation plant, according to Robert N. Frazer, president. Early installation at the company's Marion property is planned.

★ Delhi Fluorspar Corporation, which recently sold its Delhi-Babb fluorspar mine to Ozark-Mahoning Co., has taken a lease and option on the Hickory Cane fluorspar mine, 3 miles from Marion, Claude A. Fletcher, president, announced. The property, located on the "Big Four" fault and producing fluorspar and zinc, was leased from Spartan Minerals. A new shaft is being sunk.

★ Installation of a Sink-and-Float plant at the Senator zinc-lead-fluorspar mine, near Princeton, in Caldwell County, Ky., has been started by Minerals Flotation Corporation, headed by P. J. Bertelsen. Lee Marriott is superintendent at the Senator. The company also has under lease the Meadows fluorspar mine, in Caldwell County, and operates a flotation mill at Marion.

★ Crystal Fluorspar Co. recently found a 3-ft. vein of lead-fluorspar ore after crosscutting 200 ft. from the new Jefferson shaft, 6 miles northwest of Rosiclare, Ill. Samples from the first 500 tons mined show 75% fluorspar, 10% lead, and 0.30% silica. The company sank the Jefferson shaft a few months ago.

★ Operation of the Bill Wright fluorspar mine, near Lola, Livingston County, Ky., has been resumed by Kentucky Fluorspar Co. The company has held the property under lease for about ten years and operated it at intervals during that time.

★ C. H. Johnson, of the U. S. Bureau of Mines, made a recent examination of fluorspar mining and milling operations at Rosiclare, Ill., with a view to determining whether or not the prospective life of operations would justify construction of an Ohio River floodwall at Rosiclare. He indicated he would file a report to the effect that construction would be justified. Major fluorspar operators are interested in the floodwall proposal because periodic Ohio River floods result in flooded mines and interruption of mill operations.

★ As part of an extensive program of plant expansion and improvement, Aluminum Ore Co., Fluorspar Division, at Rosiclare, Ill., has completed a new $54,000 change building. It is a two-story structure of brick, steel, and concrete and houses a modernly equipped change room for employees and a large assembly and conference auditorium.

NORTH CAROLINA

Tungsten Mining Corp. finds new ore at depth—Feldspar Milling Co. builds flotation plant

★ Diamond drilling at the property of Tungsten Mining Corporation, in Vance County, has indicated a new deposit at depth, according to an announcement by Hewitt S. West, president, who stated that a drill hole intersection at 750-ft. depth had disclosed a wide vein carrying substantial tungsten values. The deepest working at present is the 300-ft. level, where the orebody averages 18 ft. in width and tungsten content runs in excess of 1½% WO_3 per ton. The new vein is said to be wider where intersected. The company is owned one-third by General Electric Co. and two-thirds by Haile Mines, Inc. Frank H. Bishop is general manager.

★ A modern flotation plant to process feldspar is to be built at a cost of $500,000 at Spruce Pine by the Feldspar Milling Co., Inc., according to recent announcement. Orders have been placed for the machinery and equipment. The plant will be situated on a 160-acre tract which the company acquired and which has been extensively drilled. Between 75 and 100 workers will be employed. C. P. Rogers, of Tryon, president of the firm, will be general superintendent of the new plant. Other officers of the company are L. A. H. Durham, of Asheville, secretary and treasurer; and C. P. Rogers, Jr., of Burnsville, vice president.

★ The mineral research laboratory of North Carolina State College, Asheville, was to be dedicated May 5, with principal addresses by J. Melville Broughton, of Raleigh, former governor; P. B. Ferebee, of Andrews, mining executive and a member of the board of directors of the TVA; Col.

John W. Harrelson, chancellor of N. C. State College; and Brandon P. Hodges, of Asheville.

SOUTH CAROLINA

Massive topaz is produced from old Brewer gold mine

★ North Carolina Exploration Co. is producing an average of one car a week of massive topaz ore from the old Brewer gold mine, in Chesterfield County, and has installed facilities to double this output. Demand for this material in the steel and refractory industries, as well as other uses, has been far exceeding the capacity of the operation. According to M. R. Hilford, of Naples, N. C., a principal in the company, the size of the deposit is proving much more extensive than believed, and a further expansion of production facilities is in prospect.

GEORGIA

Old properties are reopened as interest in gold revives

★ A revival of gold mining has started in Georgia. Two mines are in operation and others may be reopened. J. C. Abbott and Marvel Lynch and associates, of Laurel, Del., have taken over the former Calhoun Mines, Inc., three miles south of Dahlonega, in Lumpkin County, where vein gold was first discovered in 1828. The new operators have driven a 500-ft. crosscut to intersect the Calhoun vein about 100 ft. below the old workings. Drifts are being driven and stoping is being done near the level of the old workings. It is planned to install 1,500 ft. of pipeline and pump water from the river to the top of the mountain for washing the saprolite down to the ore-bearing rock. It is believed that the saprolite carries some values.

★ L. L. Pratt, from Pennsylvania, has taken over the old Dupree properties, near Acworth, and started gold mining. The 10- to 20-ft. overburden is being stripped by power shovels and ore will be mined from the open cut. It is planned to wash the overburden. A stamp mill will be erected.

★ House Bill 453, seeking to reorganize the State Department of Mines, Mining and Geology and remove educational qualifications for the director, is being opposed by the Georgia Engineering Society. It would permit the director to substitute practical experience in geology or mining for college training, but does not stipulate the period or type of experience. It would also require the department to establish divisions of marketing and ceramics. Garland Peyton, State Geologist, said that the department has authority now to establish such

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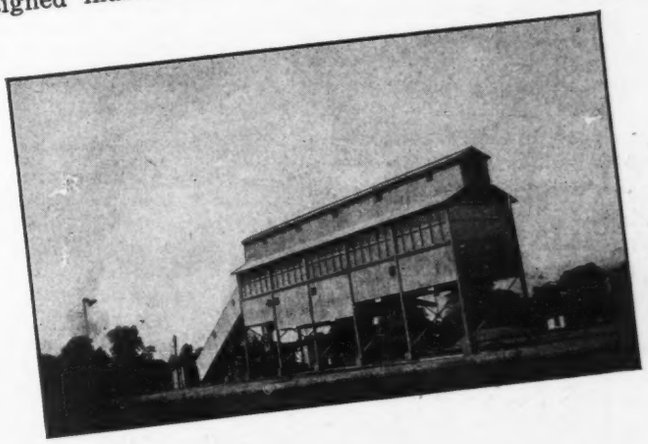

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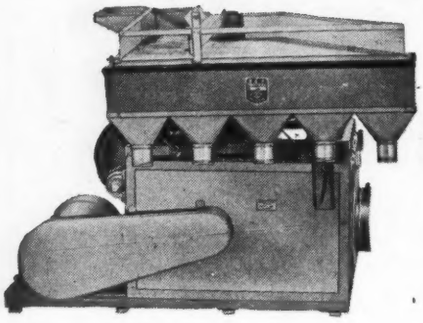

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Georgia *(continued)*

divisions, but stated that it is not feasible to set up a division of ceramics since the Georgia School of Technology has a more capable division than could be provided.

IRON COUNTRY

Cliffs Shaft production slowed by shaft trouble—Pickands, Mather sites plant at Aurora

★ Although water shipments of iron ore started the middle of April, all open pits on the Marquette Range remained idle and were not expected to begin shipping until after May 1. These included the Tilden mine of Cleveland-Cliffs Iron Co.; the Volunteer mine of the Pickands Mather Co.; and the Richmond mine of M. A. Hanna Co. The Tilden mine loaned most of its new-style churn drills to the Steep Rock mine last fall, and they have not been returned.

★ At the third auction of leases by the State of Michigan, the Syracuse Mining Co., of Cleveland, Ohio, secured 842 acres of land lying south of Marinesco, in Gogebic County.

★ Proxies have been received by shareholders of Cleveland-Cliffs Iron Co. and Cliffs Corporation explaining plans for combining the two companies under the name of the former. In the new set-up E. B. Greene, chairman of the board, will be chief executive officer, with general authority over the affairs of the company, and A. C. Brown, promoted from vice president to president, will be in charge of operations. William G. Mather recently resigned as chairman of the board because of ill health, and has requested that G. B. Young, his personal counsel, represent him on the board of the new company.

★ Because of decayed timber sets in the shaft which were squeezing out into the skip compartment, it has been necessary to close down the "B" shaft of the Cliffs Shaft mine, at Ishpeming, Mich., slowing down production to the hoisting capacity of "A" shaft. While new timber sets are being installed, the dumps on surface formerly built of timber will be replaced by structural steel.

★ Announcement has been made by R. S. Archibald, manager of North Range Mining Co., that the company's Mary Charlotte mine, south of Negaunee, will close in the near future due to exhaustion of ore reserves. At present most of the ore is obtained from a Jones & Laughlin reserve adjoining the mine on the north.

★ The selection of a site three miles north of Aurora for construction of a preliminary plant for the manufacture of iron-ore concentrate from taconite has been announced by A. D. Chisholm, general manager of Pickands, Mather & Co. The plant will use full-sized commercial equipment, and is designated to produce from 175,000 to 200,000 tons of concentrates per year from about 600,000 tons of crude taconite. The project involves an expenditure of about $1,500,000.

★ A test case to determine whether the State of Minnesota will receive about $25,000,000 in royalties on iron ore was argued on May 6 before the State Supreme Court. Considered one of the most important questions to come before the court in many years, the action involves specifically the title to the bed of Syracuse Lake, in St. Louis County, and the iron ore in the bed of that lake, estimated to contain about 4,000,000 tons. Attorney General Burnquist says, "it is a test to ascertain the title to about 50,000,000 tons on which the State, if successful, will receive royalties of $0.50 per ton."

★ R. T. Elstad, president of the Oliver Iron Mining Co., announced recently that the Vermilion district of the firm would be combined with the Virginia-Eveleth district, with W. J. Walker, Virginia, Minn., in charge. W. J. Kaiser now is general superintendent of the Virginia-Eveleth district. Present offices of the Vermilion district will remain at Ely temporarily.

MICHIGAN

Continuation of premium price payments urged by Lovell

★ Endicott R. Lovell, president of Calumet & Hecla Consolidated Copper Co., believes that price protection for the copper industry in the United States should be continued after the Premium Price Plan expires on June 30. "Congress should promptly legislate a new premium price plan," he asserts, "and should so overhaul the tax laws as to provide incentive for the use of risk capital in mining ventures. Without these measures, national security will be seriously threatened by failure to extend known reserves and develop new orebodies as present mines become exhausted." Lovell comments that although the price of copper is fairly high at present, the shortage of copper, the unsettled international situation, and the suspension of the import tax make continuation of premiums desirable.

"During the past year," he says, "the plan also has been used to encourage exploration for new ore deposits. The present inability of domestic mines to increase production is largely due to the suspension of exploration and development work during the last 15 years—the direct result of extremely low prices."

Although producers of the Michigan district are now able to make a small profit, a price recession without price protection would easily put them in the red, according to the mine manage-

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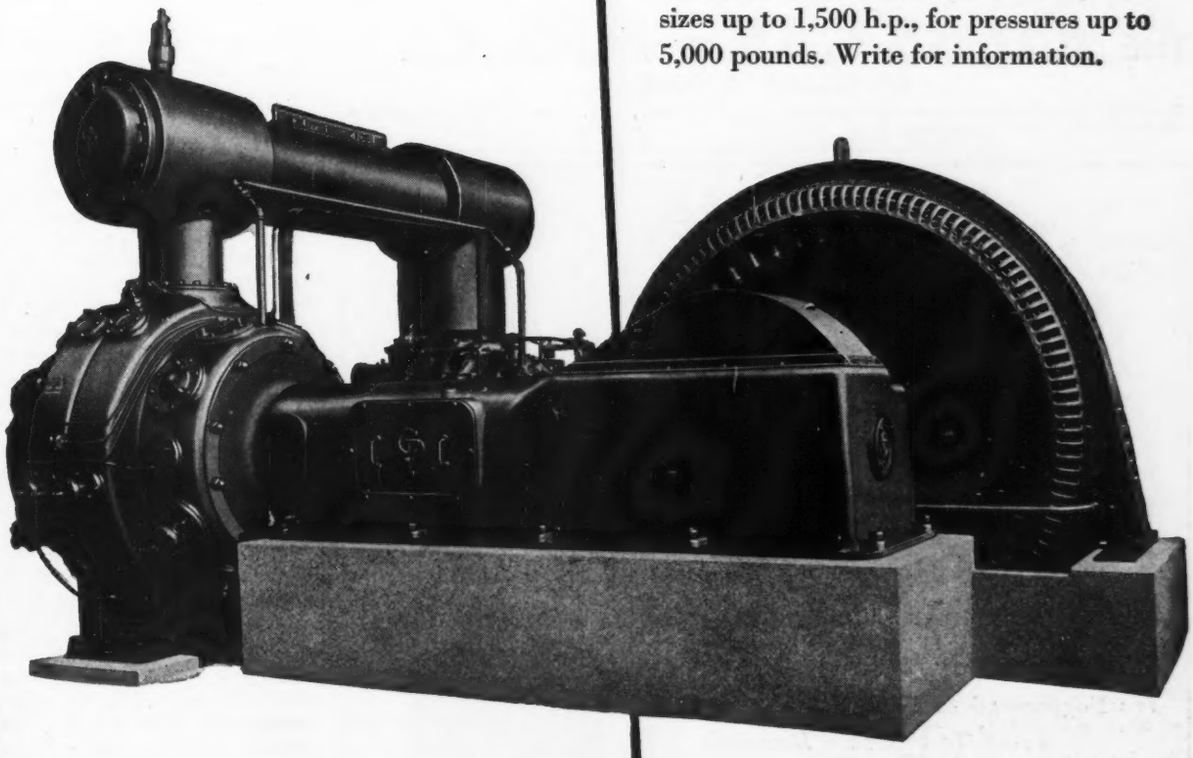

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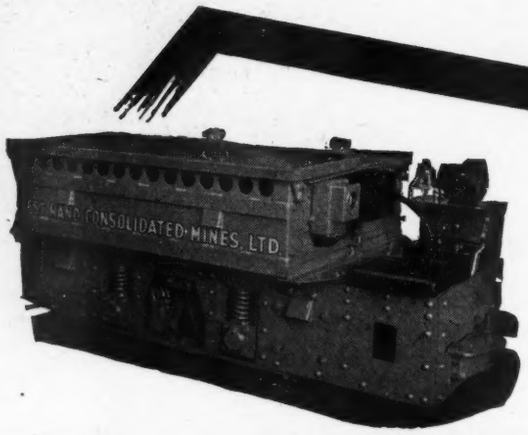

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Michigan (*continued*)

ments, force the closing of some shafts and a serious curtailment or abandonment of exploration and development work.

★ Calumet & Hecla's new fabricating plant, which is being erected at Decatur, Ala., will cost approximately $8,000,000. It will augment the facilities of the Wolverine Tube Division, in Detroit, where the buildings and land available did not lend themselves to economical expansion. Operation of the new plant should commence early in 1948. It will be financed partly from company funds and partly by term bank loans.

Production by the Wolverine Division reached an all-time high last year, shipments exceeding those of the previous year by 57%. The backlog of orders continues large. Because of lack of adequate production facilities and the effort to meet requirements of customers of long standing, it has been necessary to refuse much desirable business.

ALASKA

Active gold-dredging season is indicated—Dant & Russell to drill Chichagof Island claims

★ The Fox Bar 600-ton dredge, with 64 buckets of 2½-ft. capacity, which was purchased by an Anchorage syndicate from Riegal brothers, of Spokane, Wash., for $150,000, and is located 120 miles north of Nome, on the Kougarok River, will start work this spring, according to P. J. Cutting, manager. A. B. Michels and A. I. Henderson, of Anchorage, and B. A. Klesinger, of Fairbanks, are also interested in the project. Work was done at the property last season in preparation for this year's operation.

★ Arctic Circle Exploration, Inc., expects to employ about 100 men in thawing, stripping, and operating two dredges alternately at its property, near Candle, according to George Hellerich, manager.

★ According to Ernest N. Patty, manager of McRae-Patty placer gold-dredging operations, five dredges will be in operation on tributaries of the Yukon River before the season ends. Ben Cedermalm, superintendent of the Woodchopper dredge, went to Fairbanks in early April to prepare for early operation on Woodchopper Creek, and another dredge will operate on Coal Creek. Both of these operations are near Circle. The other three dredges will be operating in the Yukon area.

★ Kelly Willow Mining Co. will employ about 20 men this season at its property, 50 miles west of Wasilla, according to Lee Dolan, of Anchorage. A larger mill will be built.

★ Ralph Lomen, of Nome, expects to start work in June at the Shamrock gold-quartz mine, which he has optioned from R. W. Silver. The property is near Big Hurrah, in the Solomon River district.

★ Dant & Russell, Inc., of Portland, Ore., plan diamond drilling this season at the Gypsum Camel claims, 35 miles from Juneau, on Chichagof Island, according to B. D. Stewart, Commissioner of Mines for the Territory.

★ U. S. Smelting, Refining & Mining Co. has opened an office in Seattle, Wash., to recruit labor for its mines in Alaska. Although more men are said to be available than had been anticipated, the continued shortage of mining labor was a subject of discussion at the Alaska Miners' Association's last meeting in Seattle on April 25.

★ Alaska Juneau Gold Mining Co. had a net loss of $166,125 in 1946, compared with a loss of $103,643 in 1945, according to the report of the company's president, C. A. Norris, to stockholders.

★ Sixteen partners who prospected a gold-mining property on Pocahontis Creek, in the Koyukuk district, in 1946, have now formed Gold Dredge Estate, Ltd., which will operate this year, according to the company's field manager, R. R. Reid. It is planned to take a gold-washing machine, a dragline scraper, and caterpillars to the property this season.

★ Al Anderson, secretary of the Alaska Miners' Association, told members at a meeting in Seattle that "every mine operator in Alaska must now apply for a license to mine and pay a tax on net income from mining in the Territory regardless of the amount of profit." This applies to all net income from mining in excess of one thousand dollars.

CANADA

Starratt Olsen readies milling plans — East Malartic disaster probed — Polaris-Taku opening good ore—Yukon active

★ The suspension for two years of the 4¢ per pound duty on copper entering the United States is not expected to make it possible to develop markets for Canadian copper in the United States, although that is regarded as the logical export outlet. Great Britain and Europe have for some years been the major foreign market, and will probably continue to be supplied with Canadian copper, in view of the prospect of only temporary access to United States consumers.

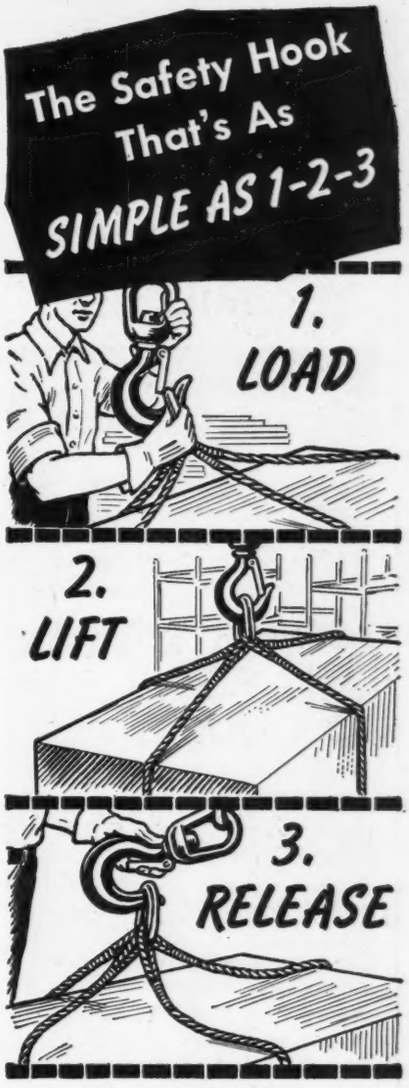
★ Eldorado Mining & Refining, Ltd., since 1943 a State-owned uranium producer at Great Bear Lake, Northwest Territories, has received more than $2,000,000 in an out-of-court settlement of a civil action against two men and two companies, Reconstruction Minister Howe announced in Ottawa on April 29. Criminal charges, alleging conspiracy to defraud the company prior to 1943, were withdrawn last year in a Toronto court, and the Government now considers the matter closed. Information of a secret character led to withholding information on the settlement, which was to be made partly in cash and the balance in the return of metals. The settlement is said to involve the purchase by other governments of fissionable materials.

★ Early approval by Parliament of the bill granting a charter for the Quebec North Shore & Labrador Railway Co. is expected. The Senate railway committee took favorable action on March 27 and the private bill came up for discussion on April 26 and May 6 in the House of Commons. The Hon. Lionel Chevrier, Transport Minister, stated the probable cost of about $100,000,000 made it impractical for Canadian National Railways to undertake the construction project. The proposed route of about 350 miles extends north from Seven Islands, on the Gulf of St. Lawrence, to the new landing field at Knob Lake (see map, *E.&M.J.*, May 1947, p. 122). Timmins and Hollinger mining interests control the railway company, which will be capitalized at $2,000,000. Within five years construction must be started, and the work is to be completed by 1957. The charter will also authorize the company to generate and sell electricity, operate steamers, docks, and pipe lines, and to acquire and run hotels and parks. Labrador Mining & Exploration Co. was stated to have spent $565,000 for prospecting activities up to the end of 1946. The right to mine in Labrador is contingent on starting production before Jan. 1, 1958, by the mining companies undertaking operations.

Labrador Mining & Exploration Co. announced that freight amounting to more than 300 tons had been taken in by plane before the end of April and stored at the all-weather landing field near Knob Lake. Quonset huts, cabins, and tents are being erected for a crew of 150 men, who will be employed this summer in building 40 miles of roads to connect with diamond drill set-ups and 500 ft. of tunneling that will develop deposits of high-grade iron ore. John Little, formerly manager of the Normetal mine, has been appointed general manager of the new project.

ONTARIO

★ International Nickel Co. of Canada, Ltd., sold nickel in all forms in 1946 amounting to 201,103,234 lb., compared with 201,572,987 lb. in 1945. Sales in the United States and other countries increased, but Russia, Germany and Japan have been eliminated from the present list of industrial



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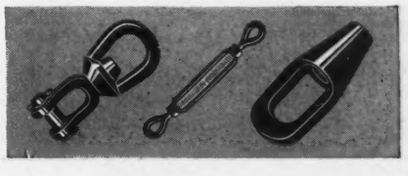

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Canada *(Continued)*

consumers of Canadian metal. Russian control of the Petsamo mine resulted in cutting off shipments to that country. Last year marked a substantial increase in the consumption of nickel in cast iron, and a new product, nickel oxide sinter, has been developed for alloy steel and stainless steelmaking. A new plant to manufacture nickel oxide sinter is being constructed this year at a cost of $8,000,000. Robert C. Stanley, president and chairman of the company, reported at the annual meeting that research developments were adding to the uses of nickel, particularly for precision castings, welding electrode, and various high-temperature alloys and alloy steels.

★ M. S. Fotheringham, vice president and general manager of Steep Rock Iron Mines, Ltd., reports that operating problems have been solved and ore shipments will be made from now on as fast as available ore cars will allow. The objective this year is to ship 1,250,000 tons including low-grade ore remaining in the stockpile. Shipments in 1946 amounted to 993,798 tons. Before the opening of the 1948 shipping season it was planned to erect a belt conveyor for moving ore to the loading station from the pit on the "B" orebody. This would make possible an estimated saving of 50% of the charges for hauling and depreciation.

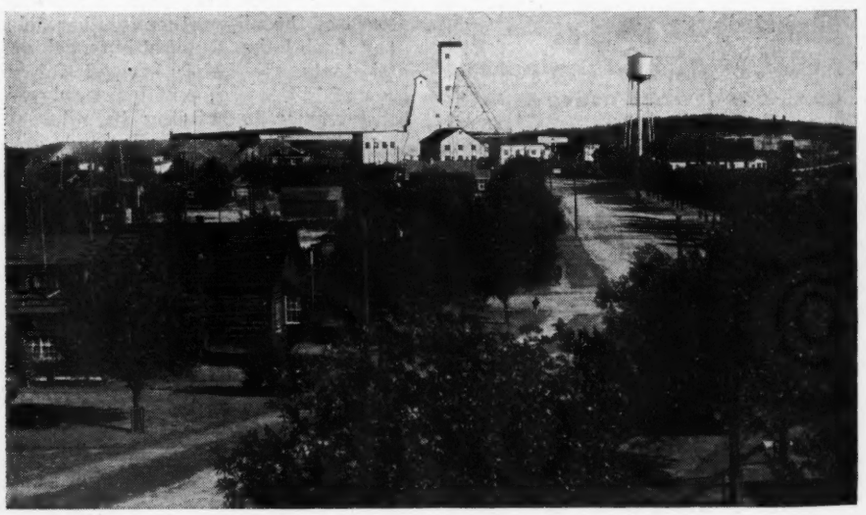
★ Starratt Olsen Gold Mines, Ltd., adjoining the Madsen mine, in the Red Lake camp, reports preparations for starting production. Under the same control as Hasaga Gold Mines, Starratt plans in 1948 to install the 350-ton mill that is now on the Hasaga property, where a plant of greater capacity will be supplied. To a depth of 900 ft. ore reserves are indicated at 350,000 tons averaging about $8 per ton. High-grade ore similar to that on surface and at the 175-ft. level has recently been found on the 550 level over widths of 1.6 to 4.4 ft. John E. Hammell is president; R J. Kilgour, mine manager; and Arthur Notman, of New York, a director.

★ Don F. Hurd has organized Skyways Explorations, Ltd., in which six prospecting companies have an interest. A Bellanca aircraft based at Geraldton will be used in testing several belts of greenstone and sediments from O'Sullivan Lake north to the Albany River, besides other areas in Ontario.

QUEBEC

★ The new No. 4 shaft at East Malartic Mines, intended to be ready by August for use in developing three new levels, was the scene of the most tragic mine accident in Quebec history on April 24, when shaft timbers caught fire and asphixiated 12 men below the 1,000-ft. level. When efforts to reach the trapped men failed, after the air line broke, water was pumped into the shaft to put out the fire. After dewatering the lower workings, recovery of the bodies was not expected to be possible before May 10. On May 7, Edward Futterer, consulting engineer, stated that mine workings were free of carbon monoxide. The town passed a resolution thanking rescue workers, doctors, and mine officials for their tireless efforts to rescue the men after they had been trapped by the fire, which burned shaft timbers up to within 75 ft. of the 8th level. Cause of the disaster was being investigated for the Quebec Department of Mines by Roger Taschereau.

★ The annual meeting of Stadacona Mines (1944), Ltd., resulted in the defeat of officers representing Ventures, Ltd. The new president is the Hon. B. M. Hill; D'Arcy D. Bogue is vice president Plans were announced for deepening the shaft from 2,718 to 3,200 ft. and installing a new hoist capable of servicing the mine down to 4,000 ft. The headframe is to be strengthened and a 1,000-ton ore



THE LAMAQUE GOLD MINE, subsidiary of Tech-Hughes Gold Mines, Ltd., has fathered the model community of Bourlamaque, Quebec. Mine headframe is in background.

bin installed, adequate for a milling rate of 500 tons daily.

★Lamaque Gold Mines, Ltd., has reached a milling rate of 600 tons a day, up from the minimum of 400 tons, and before the end of 1947 the scale was expected to improve to 1,200 tons, according to a report by Dr. D. L. H. Forbes, president and general manager, presented at the annual meeting in May. The improved ore-handling system between the 12 and 24 levels was described as a method by which the ore broken in stopes is passed down to trains of large cars on the 19 level and dumped into an ore pass. The underground crushing plant above the 24 level delivers crushed ore by gravity into loading pockets at the 24 level. A marked increase in net profit was predicted for the last half of 1947.

★Beacon Mining Co., 9 miles east of the Lamaque, which controls or holds under option a 74% interest, has tested the No. 2 shear zone for a length of 7,000 ft. A 900-ft. ore zone has been indicated by drill holes along the No. 4 vein, which is to be developed underground before the end of the year. The No. 3 vein zone, 4,000 ft. east of No. 4, is to be explored.

MANITOBA

★R. J. Jowsey, president of Squall Lake Gold Mines, Ltd., in the first annual report, for the year ended Dec. 31, 1946, states that the diamond-drilling stage of development has been completed. Shaft sinking and development of the indicated orebody, however, will be held up until the labor and equipment supply improves.

During 1946 a total of 25,056 ft. of diamond drilling was performed. G. B. Tribble, mine manager, reports that two sections of drill holes were put down on the northwest side of the basin to explore to vertical depths of 650 ft. and to depths down the dip of approximately 2,000 ft. Seventeen vertical holes in an area 600 ft. by 2,000 ft. yielded an average of 0.265 oz. gold per ton over an average width of 4.9 ft. In the same area three intersections which may represent a lower horizon gave the following results: 3.20 oz. across 2.1 ft; 0.56 oz. across 1.7 ft.; and 0.36 oz. across 2.0 ft. On the Margaret claim, the average of 124 assays of unoxidized material was 0.206 oz. gold per ton.

★G. B. Tribble, mine manager, details drift development including 571 ft. showing ore values in the annual report of Wekusko Consolidated, Ltd., for the year ended Dec. 31, 1946. The average cut grade was 0.23 oz. gold per ton over an average width of 3.72 ft. At the year's end the second level drift was 200 ft. from the area where the first good diamond drill hole was obtained. Development on the main vein was about 30% complete on the 2d, 3d and 4th levels. On the company's property comprising the Reed

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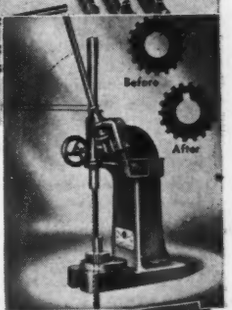

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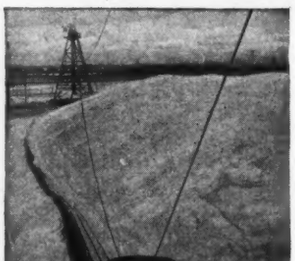

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Canada *(continued)*

Lake group, 5,117 ft. of diamond drilling indicated a lens of ore with a grade of 0.12 oz. gold per ton across 12 ft. Possible length is 200 ft.

★ The annual report of God's Lake Gold Mines, Ltd., for 1946 reveals the following: In Manitoba the company's main property has been maintained in good standing and certain areas will be further explored this year. Diamond-drill equipment and supplies were transported over the winter road, and drilling will start as soon as possible. At Lynn Lake 145 claims are held adjoining the recent copper-nickel finds in that area. In the Barrington Lake area, 30 miles northeast of Lynn Lake, the company has staked a group of 207 claims. Exploration continues on the three Quebec companies, Bevcourt Gold Mines, Ltd., Regcourt Gold Mines, Ltd., and South Dufault Mines, Ltd.

★ Recent drilling by Sherritt Gordon Mines, Ltd., on the "L" orebody at Lynn Lake, indicates the presence of an easterly pitching, lenticular, sulphide body thinning in an easterly direction. Some of the holes have reached a depth of 1,350 ft., indicating new ore possibilities below the upper zone of the "L" orebody. Hole No. 165 suggests this possibility, having averaged 0.44% nickel and 0.25% copper from 1.078 to 1,191 ft. and 1.26% nickel and 0.52% copper from 1,281 to 1,291 ft. Other drill results include: Hole No. 177, from 162 ft. to 280 ft., averaged 3.37% nickel and 1.27% copper. Hole No. 178, from 208 ft. to 442 ft., averaged 3.81% nickel and 1.37% copper. Hole No. 179, from 206 ft. to 365 ft., averaged 4.07% nickel and 1.31% copper. Hole No. 194, the most southeasterly drilling on the "L" orebody to date, cut 58 ft. averaging 4.71% nickel and 1.08% copper, followed by 153 ft. of lower-grade material. This hole is adjacent to other drilling which yielded indifferent results, and consequently signified a possible extension of mineralization eastward.

BRITISH COLUMBIA

★ An orebody has been opened for a length of 54 ft. on the 300-ft. level of the Atlin district mine of Polaris-Taku Mining Co., Ltd. With both faces and both walls in ore, the drift shows an over-all average of 0.71 oz. gold per ton. Frank H. MacPherson, manager, reports that the orebody has an indicated width of 18 ft., with grade of better than one ounce of gold per ton.

★ The 13-level crosscut driven by Privateer Mine, Ltd., in the Alberni mining division, has intersected the No. 3 vein at the lowest horizon to date. The average grade after the first three rounds of drifting is 4.45 oz. gold per ton over a width of 0.75

ft. March production was 1,165 oz. gold, valued at $41,254, from 977 tons, averaging 1.192 oz. gold per ton.

★ Returns from the first car of copper concentrate shipped by The Twin "J" Mines, Ltd., to the Tacoma smelter show a net of $3,455. The first car of zinc concentrate shipped to the Trail smelter brought net returns of $2,747. Mill heads to date have averaged 0.11 oz. gold, 2.0 oz. silver, 2.0% copper, and 7.0% zinc.

★ Shareholders of Pacific Nickel Mines, Ltd., were informed at the company's annual meeting that developments which might affect the future of the property at Choate, B. C., were being watched closely. These include the possible termination of International Nickel's patents on metal-recovery processes, thus permitting their use by the company; and the possible employment of a new process for using nickel-copper ore with an iron content to mix with other iron ore in the production of steel.

★ During the first quarter of 1947, Bralorne Mines, Ltd., in the Lillooet district, produced 14,982 oz. gold, valued at $522,520, from 32,420 tons, averaging 0.462 oz. gold per ton. Austin C. Taylor told the annual meeting of shareholders that dividend payments would probably be resumed by the end of 1947. A long tunnel will be driven to explore orebodies indicated by previous work on a group of claims on Yalakom Mountain. No development of the Taylor-Bridge River property will be attempted until sufficient manpower is available. Although diamond drilling has indicated the persistence to much greater depth of veins now being mined at Bralorne, no sinking will be undertaken until production has been restored to capacity.

★ During the year ended Jan. 31, 1947, Cariboo Gold Quartz Mining Co., Ltd., produced 14,093 oz. gold and 1.179 oz. silver, valued at $530,408, from 45,224 tons, averaging 0.329 oz. gold per ton. Net loss for the year was $182,793. C. D. Stevenson, general manager, says that the geological study to date indicates a much larger proportion of possible ore, at a lower grade, will be justified when conditions are sufficiently stable. The management is confident that ample ore is available in the meantime for increasing the daily tonnage to 500 and more when labor and material are available.

★ A crosscut on the 200 level of the property of Cariboo-Hudson Gold Mine (1946), Ltd., has cut a vein 3 ft. wide, assaying 2.3 oz. gold per ton. Drifting has been suspended until a section of badly shattered ground can be timbered.

★ Production of Granby Consolidated Mining, Smelting & Power Co., Ltd., during the year ended Dec. 31, 1946, was 10,649,842 lb. copper, valued at $1,745,440. After provisions for depletion and depreciation, the year's operating loss was $116,246. Ore reserves at the end of the year were estimated at 9,982,000 tons grading between 1.2% and 1.3% copper. During the six months of operation prior to the strike, the mill treated 597,678 tons, a daily average of 3,881 tons.

★ A third strike of spectacular ore has been obtained in the main haulage tunnel of Hedley Monarch Gold Mines, Ltd. At 35 ft. a high-grade "marker," varying in width from ½ in. to 2½ in., assayed $18,764 in gold per ton, and smaller values extended into the footwall. A crosscut, 215 ft. vertically below the tunnel, has obtained another intersection, thought to be the persistence of the same vein.

★ A crosscut is being driven from the lowest tunnel on the Rambler claim of Highland Silver Mines, Ltd., to check a diamond-drill intersection assaying 151 oz. silver, 2.4% lead, and 10.8% zinc over a width of 18 in.

★ Sheep Creek Gold Mines, Ltd., in the Nelson district, resumed milling May 1. A new vein, called the "57," has been cut on the 7-level and developed for a length of 70 ft. It is parallel to the general vein system and averages better than one-half ounce of gold over widths varying from two to three feet.

★ Vancouver and San Francisco interests have incorporated Yale Mining Co., Ltd. First work will be done in the Ainsworth district on a group of 40 claims, including such well-known former producers as the Little Mamie, King Solomon, Ivanhoe, Highlander, Krao, and Lady of the Lake. The immediate objective will be development of the Krao vein by extending the McCune tunnel. Another tunnel will be driven 500 ft. lower from the Lady of the Lake claim to explore the same vein, and the Highlander tunnel will be reconditioned and extended to explore the Highlander-Banker vein on the Black Diamond, Little Donald, and Highlander claims. All levels will eventually be connected with a new mill-level tunnel to be driven from Mile Point, on Kootenay Lake.

★ The annual report of The Consolidated Mining & Smelting Co. of Canada, Ltd., covering 1946 operations, reveals a net profit of $23,323,168, equivalent to $7.12 per share. Dividends aggregating $4.25 per share were paid to shareholders. At the Sullivan mine 2,307,532 tons of ore were mined and 1,196,324 cu.yd. of backfill were placed. Ore reserves were increased by 3,300,000 tons, of which approximately 25% was new ore, the remainder resulting from more precise calculations made possible by a series of new geological sections. Ore mined by diamond drill increased to 63% of all stoped tonnage. Early in 1946, it was decided to construct, at a cost of approximately $3,000,000 a new and modern

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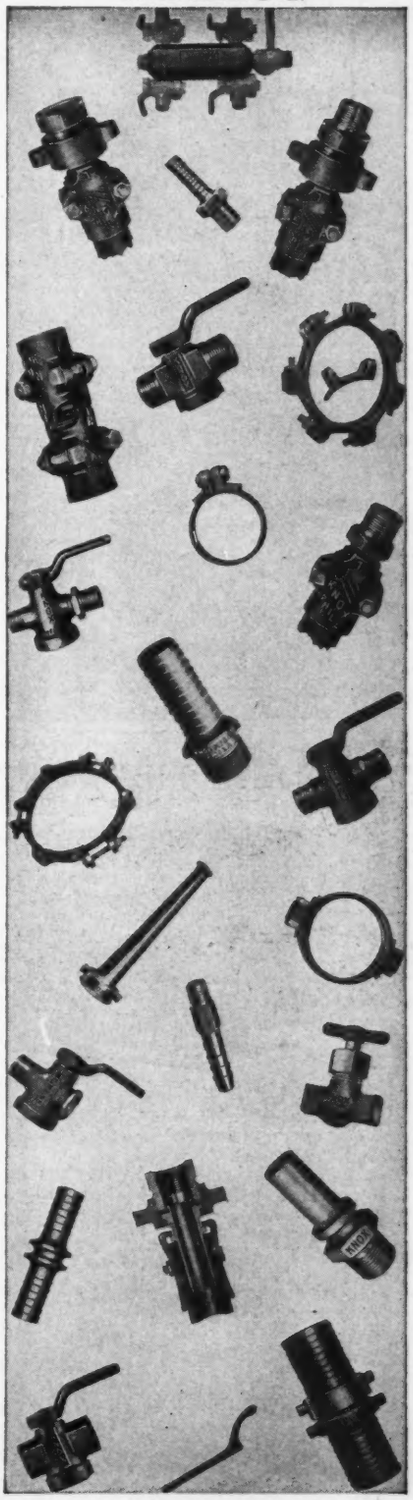

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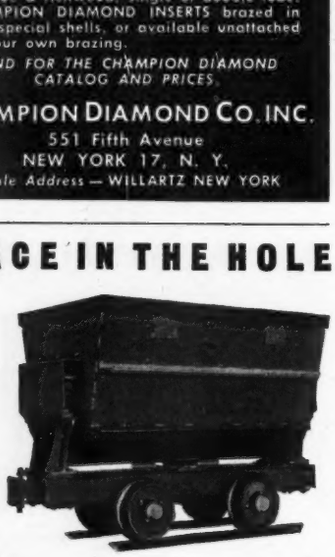

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Canada (*Continued*)

underground crushing plant, a four-mile haulageway to the concentrator, including two miles of rock tunnel, and an addition to the concentrator for preliminary treatment of the ore by the sink-and-float process. The waste material from the new plant is to be returned underground for backfill. It is hoped to complete the project by the early summer of 1948.

★ Development work continued at the Con and Rycon mines, at Yellowknife, N. W. T., and production was resumed in August after a shutdown of three years. Of 67 properties examined by the exploration department, six were acquired on option. The Tulsequah Chief property, a short distance beyond the Polaris-Taku mine, in northwestern British Columbia, was optioned in May. Subsequent diamond drilling developed a fair tonnage of gold-silver-copper lead-zinc ore of commercial grade. Underground work will be undertaken in 1947. An option was also obtained on the Fairview property, near Oliver, B. C., and the mine is now producing a gold ore of high silica content, a factor expected to effect a substantial saving when used as a flux in the lead smelter.

YUKON

★ The 600-ft. tunnel driven by Brown-McDade Mines, Ltd., has reached the vein, about 100 ft. below the surface where it has shown values ranging from $14 to $17.50 per ton over widths averaging 15 ft. for a length of 900 ft. Channel samples taken from the main zone in the crosscut averaged 0.265 oz. gold and 4.37 oz. silver per ton over a width of 16 ft.

★ The annual report of Reno Gold Mines, Ltd., for 1946 shows a net deficit of $4,358. In May 1946 the company purchased dredging ground on Canadian Creek. O. C. Thompson, managing director, says that 1,577,000 cu. yd. of gravel have been developed averaging 95¢ per cubic yard in gold, together with an appreciable content of tugsten; also 2,792,000 cu. yd. of probable reserves.

★ McRae Patty gold placer operations will again be active in the Dawson district, according to Ernest N. Patty, manager. It is expected that one of the dredges on Henderson Creek, 80 miles from Dawson, will be in production by the middle of June. Another dredge will operate on Clear Creek, a tributary of Stewart River, southeast of Dawson. It is planned to install a dredge on Thistle Creek, a tributary of the Yukon River, 100 miles above Dawson.

★ Keno Hill Company, Ltd., employed about 75 men in opening the Hector and Calumet mines, on Galena Hill, in the Mayo district, this spring. The company plans to repair its mill at the Elsa property this summer. Dr. Smitheringale, in charge for the Karl Springer interests, is opening the Angus McLeod mine, on Galena Hill, and another mine on Keno Hill. Noranda interests are employing eight men at the Rio group of claims, on Galena Hill, and are also working the Matheson claims.

★ Yukon Consolidated Gold Corporation will employ about 500 men this season. At least six dredges will be in operation. Stripping and thawing will be done on Middle and Lower Sulphur creeks, on Middle Dominion, and on Hunker and Quartz creeks. Stripping only will be done on Upper Sulphur and at Jensen, on Dominion Creek. A Marion electric shovel will be used on bench ground on Dominion Creek.

PERU

New ruling gives effect of open market for gold miners—Ancash lead-zinc field to be opened

★ The Chiquian mining region, about 30 miles east of Huaraz, in the Department of A cash, is being developed. The mines are in the Cordillera Azul (Blue Range), a branch of the Cordillera Blanca (White Range), the highest in Peru (highest peaks over 22,000 ft.). A road, some 20 miles long, is to be built from Chiquian to the mines. The region has long been known for its high silver, lead, and zinc values, but lack of communications has kept development at a minimum. With present high prices of lead and silver, many mine owners have started operations. The Caceres group, which owns the Azul mine, is installing a 30-ton flotation mill.

★ The status of the gold-mining industry in Peru has improved decidedly with the new Government ruling that gold producers may sell their gold to the Banco Central de Reserva, receiving as payment what is now known as "gold certificates." Formerly, the gold producers were not allowed to sell their gold elsewhere, and were forced to receive payment for their sales to the Banco Central de Reserva in Peruvian soles, at the official price of $35 an ounce minus taxes. The fact that the Peruvian sol has been undergoing a serious depreciation, and is at present quoted (in the black market) at about 11.50 soles per dollar, instead of the official 6.50 per dollar, placed the mines in a serious predicament, as they were forced to take soles at the official rate of exchange. The fact that gold was selling in the black market for a considerably higher price, and that the cost of production had increased, forced several important mines to shut down. With the new ruling, the gold certificates issued by the Banco Central may be negotiated as gold in the open market. Several mines are expected to reopen soon.

★ The rural area of the city of Lima

has been thoroughly prospected in recent years, in search of limestone deposits suitable for the manufacture of portland cement. Greater Lima, with a population of over one million inhabitants, has only one cement plant; in fact, that plant is the only one in existance in Peru. With a daily production of less than six thousand barrels, the Compania Peruana de Cemento Portland, located in Atocongo, some 25 miles south of Lima, supplies only a fraction of the cement required by the building industry. Recently, the very notable boom in construction, especially in the erection of large office and apartment buildings, and the substantial increase in Government projects, has taxed the cement industry seriously. At present there are several groups prospecting limestone deposits and trying to finance a cement plant for Lima.

★ The Patronato de Becas para Ingenieros de Minas has only recently been formed in Lima, under the auspices of the Escuela Nacional de Ingenieros. This group of "overseers," formed by prominent members of the mining industry, and representatives of the U. S. Embassy, mining societies, and companies, will control and supervise the distribution of the many scholarships given to mining students for American universities. In the last few years the number of these scholarships has increased notably, many Peruvians are taking one- or two-year mining courses in the United States, with scholarships donated by the U. S. Government, W. R. Grace & Co., International Petroleum Co., Cerro de Pasco Copper Corporation, and several other private companies.

MEXICO

Aleman's visit to U. S. proves encouraging — Chihuahua power strike is averted by pay rise

★ Mexican mining appears to be in a marking-time phase despite the encouragement derived from the fruits of President Miguel Aleman's recent visit to the United States. There seems to exist more confidence in the Chief Executive's ability to handle Mexico's postwar problem, but the fact remains that something like a business depression now prevails in Mexico. Of the 685 mines in Mexico, the Employers Confederation finds that 194 are idle. Most of these closed mines are in Chihuahua, Zacatecas, Durango, and Coalhuila.

★ Mining companies and individual operators are exempt from paying claims of any kind to prospectors on their properties, according to a recent ruling of the Federal Supreme Court. In the case reviewed, the Court held that while a union had contracted for working a certain mineral property or

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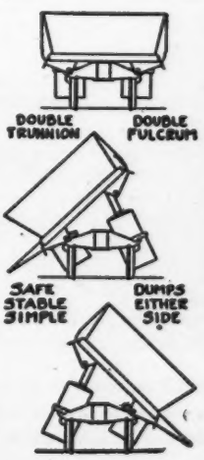

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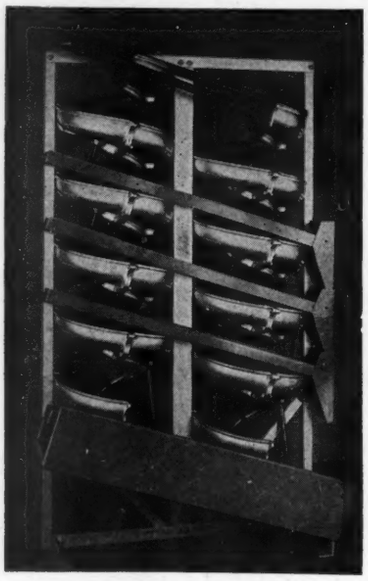

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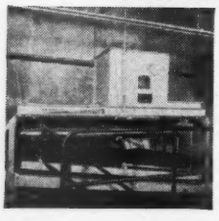

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Mexico *(Continued)*

mine, it had not contracted the prospectors as employees and they are not so regarded under the labor law.

★ The Labor Ministry recently forestalled a threatened utility strike in Chihuahua by granting the workers a 25% pay increase instead of the 50% they had demanded. The three power companies affected supply power to many mines in the State.

★ Several small mines of El Toro mineral zone, San Francisco del Oro municipality, Chih., suspended work without authorization recently, throwing more than 400 miners out of work. Owners of the mines told the Labor Ministry that the shutdown was forced by accumulation of more than 3,000 tons of ore that cannot be moved to refineries at Torreon and Avalos because train crews refuse to handle ore from these properties. "A trivial disagreement" is said to be the cause, and the Ministry has urged the railroad to investigate.

AUSTRALIA

Uranium ores sought—Big Bell to test Paddy's Flat ore—Dredge to resume in Victoria

★ According to a recent issue of the Melbourne *Argus*, plans have been made secretly by the Australian Government to cooperate with the several states to search for and develop deposits of uranium or radium. The Council for Scientific and Industrial Research is working on the application of atomic energy to industrial power supply. Australia's only known sources of uranium are at Mt. Painter and Radium Hill, in South Australia, where the net content of the more extensive Mt. Painter deposit is estimated at two tons of uranium trioxide.

WESTERN AUSTRALIA

★ Big Bell Gold Mines has a 12-month option over most of the leases on Paddy's Flat, at Meekatharra, and the company plans to test 10,000 tons of ore from the area in a pilot plant. This, plus the projected large-scale diamond drilling program there, is said to be the biggest mining development in the Murchison gold fields since early this century.

★ It is hoped to base an asbestos industry on the extensive deposits found in the Hamersley Ranges, 180 miles southeast of the port of Roebourne. The proportion of long fiber is high, the quality is good, and recovery of commercial fiber has been satisfactory. The northern face of the range is actually a very long fault scarp, from which deep gorges extend back into the range, exposing the asbestos seams in the cliff faces. The operating company, Australian Blue Asbestos Co., has opened up its mine for large-scale production and erected a diesel-electric power plant and a treatment plant. The company may supply Australian requirements, and an export trade may even be established.

VICTORIA

★ The largest dredging enterprise in this State is that of Harrietville (Tronoh), Ltd., at Bright. The property has a content of 96,000,000 cu.yd. running to a depth of 130 ft. with an average gold value of 1.92 gr. per cubic yard. The bucket dredge has a designed capacity of 350,000 cu.yd. per month and a digging depth of 130 ft. Dimensions of the pontoon are: length, 300 ft.; width, 72 ft.; depth, 12.5 ft. Buckets are 20-cu.ft. capacity. Gold near bedrock is not recovered, and values still run below the average of the property as disclosed by boring. Gold recovery is 0.74 gr. per cubic yard and working costs average 6.5 pence per cubic yard.

THE URQUHART SHAFT and part of the crushing plant at Mt. Isa Mines, Ltd., in Queensland, Australia. Ore is hoisted in two 10-ton skips from a depth of 800 ft. at the rate of 500 tons an hour. British Combine photo.

NEW GUINEA

★ Bulolo Gold Dredging, Ltd., is making steady progress toward resumption of operations, although much delay has occurred in obtaining plant and materials for repair. The company has eight bucket dredges on its property, which were rendered unusable during the invasion. The hydraulic power plant, workshops, and buildings were destroyed at that time. It has been necessary to order complete hydro-electric units for the replacement of the original machines in the power house, and this, and subsequent delivery, have taken considerable time. To supply power to the workshops a temporary hydro-electric generating set was installed at the site of the lower power plant, and work for the restoration of the upper plant, which consisted of two 1,400-hp. units, is progressing well. The turbines and generators have been delivered and are being erected.

Work will begin on the lower power plant, which will supply 5,000 hp. Increased power will speed up reconditioning the dredges. Pending delivery of certain units, it is not possible to forecast the date of resumption of dredging. Reserves are estimated at 150,000,000 cu.yd., of which 129,000,000 is suitable for bucket dredging and the remainder for hydraulic sluicing. Originally, all materials and stores were carried by airplane from the coast to the mine, but during the military occupation, a road was built, and supplies are now carried by motor truck.

PHILIPPINES

Batong Buhay cleans tunnel—No let-up in chrome demand—Big Wedge's output half prewar

★ At Batong Buhay, most northerly gold producer in Mountain Province, a crew is cleaning up the 1,230-drainage and haulage tunnel, and by May 1 it had advanced about 2,000 ft. from the portal, placing it 400 ft. from the interior hoisting shaft. Sinking of this shaft had been started before the war to proceed to 1,430 ft., at which depth it was planned to connect with a long adit to be driven 3,000 ft. only 30 ft. above the level of the Pasig River. At 1,400 ft. the shaft ran into heavy water, which increased in volume as sinking proceeded. It is reported that ore extension at this depth appeared highly encouraging. In addition a new vein, the Sawmill, 700 ft. west of the Dickson, which had yielded most of the mill tonnage, had a good showing and warranted full development. The Batong Buhay surface equipment, including the 150-ton mill and power plant, is in surprisingly good condition. Plans for starting production at the mine are still in abeyance until new financing can be arranged. International Engineering Co. has an operating contract on the mine.

★ Work is steadily progressing at the new mill for the combined Benguet and Balatoc properties, although delays in delivery of new equipment from the United States have again caused the management to postpone the date of operation. Though prewar wage scales, plus a rice allowance for the native miners, are still being paid, it is anticipated that some advance to meet the higher living costs will be required when production begins. In the meantime the Baguio area has been free of strikes.

★ The report of Consolidated Mines, operating the Masinloc chrome ore deposit under a profit-sharing agreement with Benguet Consolidated, discloses that a total of 80,000 tons (value $609,196) had been shipped up to March 1, 1947, since production was started last year. Operating expenses were $356,136 and the profit from shipments was $253,000. A total of $238,500 has been spent on rehabilitation of roads, wharf, bridges, and purchase of new equipment. The mine is now able to produce 24,000 tons of ore per month. Difficulties arising from inexperienced labor had made it impossible to maintain deliveries of ore at more than 12,000 tons per month, but these are being gradually overcome.

★ April production from the Big Wedge mine, operated by Atok Gold Mining Co., was 6,313 tons, valued at $173,250, or an average of $27.40 per ton. Production rate is about half prewar, as only one 225-ton mill unit has been repaired. The mill is built in two units. To repair the first unit the second has been partly stripped of its equipment. Resumption at the old prewar rate of 400 tons a day is planned as soon as necessary replacements arrive from the United States. It is announced that plans are being considered for enlarging the mill to handle between 800 and 1,000 tons per day when mine development work has been sufficiently advanced and more equipment is available. Top slicing has been introduced to reduce costs of the former square sets.

AFRICA

First Free State shaft reaches 258 ft.—March returns show profit—Interest in chromite

★ Depth of the St. Helena shaft, in the Orange Free State, was 258 ft. at the end of April. (See photograph, *E.&M.J.*, May 1947, p.59). Progress in sinking the 30-deg. shaft has been slow because of soft ground and slow

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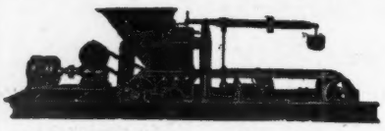

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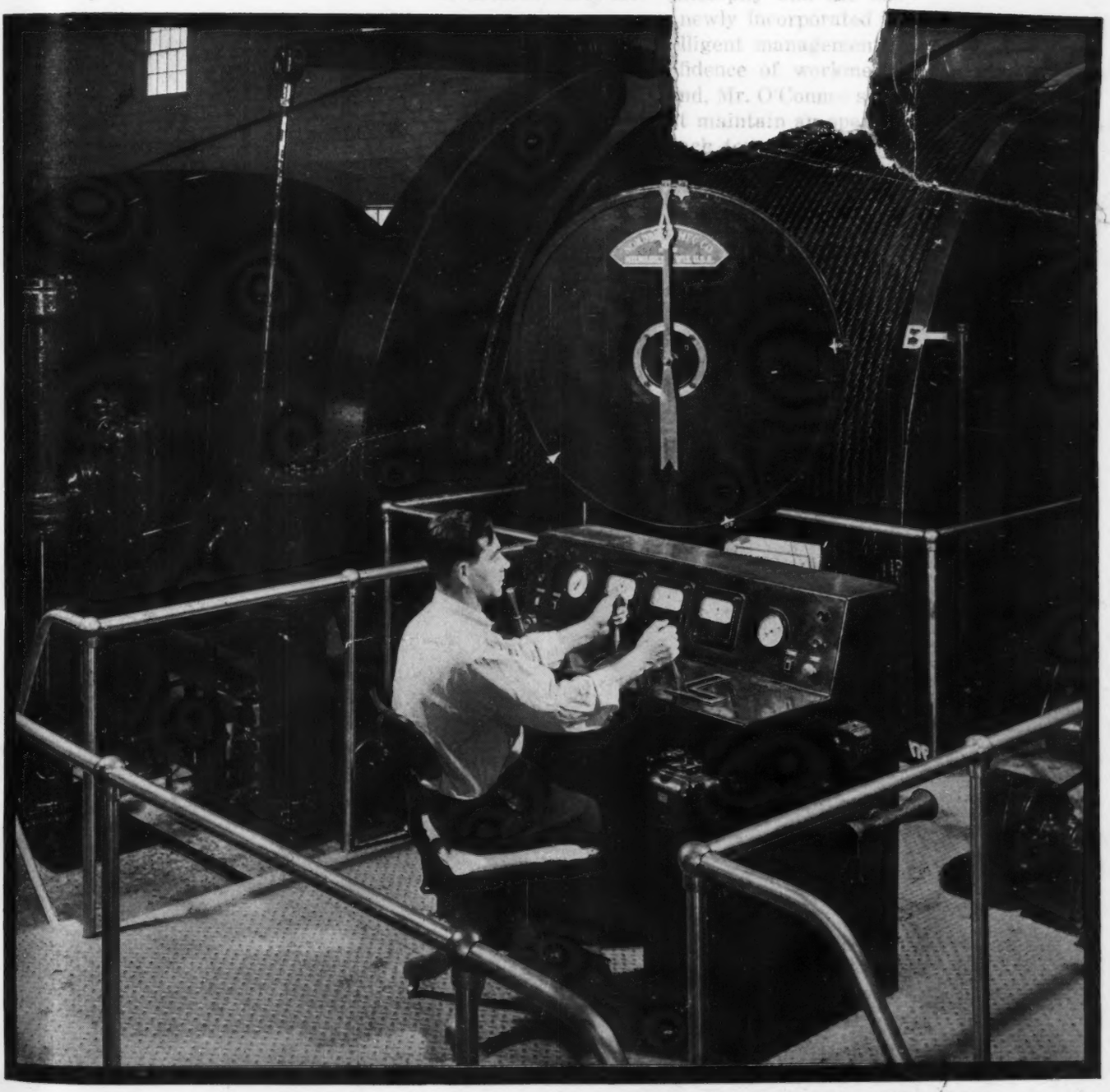

Modern equipment provides safe, effortless, hoist control at Mt. Hope mine, New Jersey

Communism Menaces the Mining Industry—Page 74

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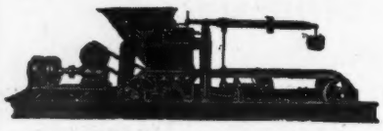

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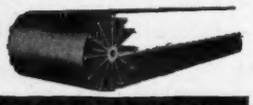

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